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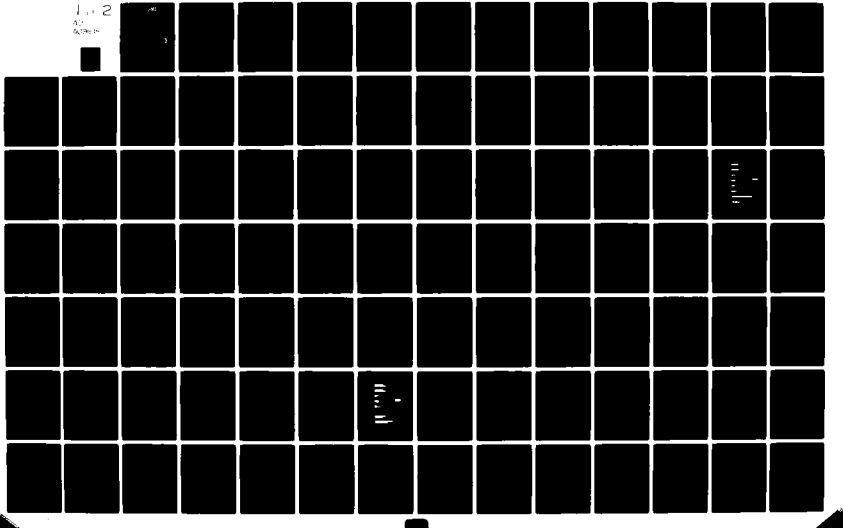

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U.S. METRIC BOARD
1979 SURVEY OF SELECTED LARGE U.S. FIRMS AND INDUSTRIES

(Final Report)

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Abstract:

A mail survey of randomly chosen 202 of the 1000 largest manufacturing and mining firms, as listed by Fortune magazine, was conducted in late 1979 and early 1980. About 64 percent (112 firms) responded with useful data. Among the findings are:

- about 63 percent of the largest firms produce at least one metric product;
- about 48 percent of exported sales are of metric products;
- about three quarters of the firms selling metric products sell products labelled in customary and metric units (soft conversion);
- about half the firms selling metric products sell hard converted products (products manufactured in metric units);
- little corporate coordination and planning seems to accompany conversion to the metric system;
- about one-third of the firms see laws and reputation impeding conversion;
- over 50 percent see lack of customer demand as inhibiting conversion;
- the most realistic time period for conversion is 10 years, the minimum time for conversion (under pressure) is three years, and the perferred time (at the firm's own pace) is eight years.

U.S. METRIC BOARD

1979 SURVEY OF SELECTED LARGE U.S. FIRMS AND INDUSTRIES

(Final Report)

Prepared by:

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U.S. Metric Board
1815 N. Lynn Street
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May 15, 1980

DISCLAIMER

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FOREWORD

The metric debate in the United States is as old as the country itself and began with the signing of the Constitution. Article I, Section 8, of the Constitution gives the Congress power to fix the national standards of weights and measures, and throughout the country's history numerous plans, reports, committees, and agencies have evaluated these standards.

Several proposals have been presented to the Congress from 1790 to the present. However, it was not until 1968 that the Congress decided to study the impact of the metric system on the United States. Responsibility for conducting this study was given to the National Bureau of Standards (NBS). This study, published in 1971, concluded that the U.S. was increasing its use of the metric system and will eventually "join the rest of the world in the use of the metric system as the predominant common language of measurement." (1)* The report also urged that the transition to the metric system be carefully planned and voluntary among all sectors. The NBS study group received criticism with regard to its impartiality and completeness; there were contentions that the study group did not adequately address the costs and benefits of metrication. (2) Bills were introduced in Congress to implement the report's recommendations. None passed until the requirements of a deliberate national conversion program and a deliberate target date, with changeover costs lying "where they fall" (1), were removed.

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* Parenthetical numbers refer to sources listed in Appendix E, Bibliography.

On December 23, 1975, the President of the United States signed the Metric Conversion Act of 1975 (PL 94-168), which declared that the policy of the U.S. is to plan and coordinate the increasing use of the metric system. The Act also established the U.S. Metric Board (USMB) to coordinate the voluntary conversion to the metric system. Specifically, Sections 6(1), 6(8), 6(9), and 6(10) require USMB to:

- Consult with and take into account the interests, views, and conversion costs of United States commerce and industry (6(1)).

- Collect, analyze, and publish information about the extent of usage of metric measurements; evaluate the costs and benefits of metric usage (6(8)).

- Conduct research, including appropriate surveys; publish the results of such research (6(9)).

- Submit annually to the Congress and to the President a report on its activities (6(10)).

In 1978, the U.S. General Accounting Office (GAO) published a detailed report to the Congress regarding possible implications of the metric system on the nation. (2) In its report, the GAO concluded that one measurement system "should be predominant because the existence of a dual system for any length of time is impractical, inefficient, uneconomical, and confusing." The GAO stated that the decision "as to which system is to be predominant . . . should be made by the representatives of the people -- the Congress."

Recommendations were made to USMB and OMB regarding specific actions to be taken to help ensure that the public be well informed of the advantages and disadvantages of metrication. The USMB was urged to ensure that "its policies and actions do not advocate or discourage the use of one system over the other" (in essence, properly reflecting national policy) and that the full impact of metrication be assessed before voluntary conversion takes place.

These two aforementioned studies indicate that metrication is taking place in the U.S. The overall picture is complex and affects all areas of our economy and all population sectors.

Lisa L. King
Author

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SECTION 1
SUMMARY OF FINDINGS

This section provides a brief summary of the results of the 1979 survey of selected large U.S. firms and industries. The summary is divided into a short description of the objectives of the survey, a status report on metric conversion, a discussion of factors which may impede metrication, and the time frames for metrication.

1.1 Survey Objectives

In passing the Metric Conversion Act of 1975, the Congress established the U.S. Metric Board (USMB) to coordinate the increasing use of the metric system. Section 6(8) of the Act instructs the U.S. Metric Board to collect, analyze and publish information about the extent of usage of metric measurements. In carrying out its mission, the U.S. Metric Board conducted a status survey of large business.

Briefly, the objectives of the survey were to report the status and projections of metrication among large U.S. firms and industries, and to provide both government and industry with information regarding voluntary conversion to the metric system. A sample of the nation's largest 1000 industrial firms, determined by 1978 annual net sales as listed in the Fortune magazine (3, 4), was surveyed. The total sample of 202 companies was proportionately selected at random based on two criteria: inclusion in either the top 500 or second 500 category of the Fortune 1000 listing and inclusion in one of five industry groups (transportation, consumer products, manufacturing and production,

aerospace and electronics, and entertainment). Appendix A contains a fuller description of the sampling procedure. The response rate was over 64 percent which is sufficient to provide a sound basis for understanding the progress and related elements of voluntary metric conversion. The response rate was achieved through one mailing and concentrated telephone follow-up (see Section 2.3, for further detail).

1.2 Status of Metric Conversion

For this report, the current status of metrication is seen from two perspectives: the number of companies involved and the percentage or volume of sales of metric products. Distinction between types of conversion is also an important characteristic in qualifying the current status of metrication. For the purposes of this study, three methods of conversion are used, and defined as follows:

> Soft conversion refers to the expression of customary units of measure in their direct metric equivalents, whereby there is no physical change in the dimensions of the product itself. Soft conversion is often described as dual labeling.
>
> Hybrid conversion or hybrid metric products represents the use of both metric and non-metric parts, components, and/or materials.
>
> Hard conversion defines a product that has been designed and/or manufactured using metric as the only or the preferred system of units.

Of the total net sales, 32 percent are currently metric (21 percent soft converted, 5 percent hybrid converted, and 6 percent hard converted). Of the 112 firms responding to the sales volume question, 63 percent (70 firms) are producing at least one metric product. A greater proportion of exported sales are in metric units (48 percent) than are U.S. sales (29 percent). In some cases, companies convert products destined for the foreign market only. The Fortune 500 group exhibits a greater percentage of metric sales (33 percent) than do those companies in the second 500 group (24 percent); sales in domestic and foreign markets are combined for this statistic.

It was found that more companies are selling soft converted products than either hybrid or hard metric. Approximately three quarters of the 70 companies that sell metric products are using soft conversion, one quarter are using hybrid conversion, and one half are using hard conversion. The total is greater than 100 percent because companies sell different products with different methods of conversion; some companies are producing in all three conversion categories. At present, an unanswered question is what factors cause a firm to choose particular conversion categories; are the influences related principally to convenience, cost, opportunities for export sales or other, unrecognized factors?

A second area of voluntary conversion examined is the presence of planning and coordination activities. Eighteen metric activities, previously identified by experts and used in precedent studies such as the GAO report (2) are used to assess metric planning and coordination. The 18 activities cover areas such as corporate planning, industrial coordination, coordination with

government, and implementation of activities related to metric production. The status reported for each activity reveals that 60 percent (78 companies) have at least one of the 18 metric activities in process or completed. The activity ranking first in terms of the number of companies reporting an in process or completed status is "coordinate with industry"; about 36 percent of responding firms indicated action for this activity. For each of the 18 activities, at least half of the responding companies have no plans for implementation. For 14 of the 18 activities, more than 60 percent of the companies have no plans. The three activities most frequently reported as in process or completed are "coordinate with industry," "appoint a metric coordinator," (34.5 percent of the companies) and "conduct R&D activities in metric language" (33 percent). The activity in which the fewest companies are involved is "budget funds for metric activities" (about 11 percent of the companies).

Even companies that sell metric products were found to exhibit low frequencies of reporting involvement in the 18 metric activities. Either the planning process is seen by industrial firms differently than we see it, or firms are reluctant to discuss planning and coordination, or planning and coordination, as discrete activities, may not be perceived as necessary for conversion.

Nine of the 18 activities match an equivalent number used by the GAO in its 1978 analysis. (2) (Two other activities are represented by one in the GAO study). The present study showed an increase in the percentage of firms identifying action (in process or completed) in four of the nine activities; with two

showing changes greater than eight percentage points; for the balance of the activities, three showed decreases and two no change. The greatest change is in the activity "train employees" with a 13 percentage point increase.

1.3 Factors Which May Impede Metrication

Both legal and non-legal impediments are perceived as hinderances to metric conversion by respondents. Thirty-two percent of the 130 companies perceived that one or more laws and regulations currently present an impediment to metrication. The impediments most frequently cited were state and local laws.

Nearly every respondent referred to at least one non-legal restriction. Well over 50 percent of the companies indicated that the lack of customer demand inhibits conversion, followed by the lack of industry-wide metric standards and the lack of suppliers of metric materials.

Other barriers such as costs were also noted. Numerous organizational and internal conflicts were also mentioned.

1.4 Time Frames for Metrication

The respondents were asked to state when they believed their company could complete conversion under each of three assumptions:

1. Realistic time frame: assumes no significant change in the current rate of voluntary conversion progress in the United States.

2. Minimum time frame: assumes extreme pressure to voluntarily convert would be exerted on the company (e.g., by customers, suppliers, environment, etc.).

3. Preferred time frame: assumes that the firm will select its own time frame in which it will convert.

In each of the three time frames, the range of estimated years to convert is wide spread - ranging from 0 to 100 years. There is evidence that metrication may never reach across all industry categories; seven respondents indicated that, even under conditions of extreme pressure (minimum time frame), their firms would never convert.

Using the median as the best description, the "realistic" conversion time is 10 years, the "minimum" time is 3 years, and the "preferred" is 8 years.

SECTION 2
INTRODUCTION

2.1 Overview

The proposed changeover of U.S. weights and measures from English customary units to internatinally recognized metric units has been a subject of debate for years. In adopting the Metric Conversion Act of 1975, the Congress of the United States established a national policy of coordinating and planning the voluntary use of the metric system in the United States. At the same time, the Congress created the United States Metric Board to coordinate the increasing use of metric measurement.

The key element of the national policy is its voluntary nature. Rather than occur by force of law, metrication is to proceed by the voluntary decisions of each segment and sector of our society. There is no national mandate to convert to the metric system. U.S. law permits the use of either the metric system or the customary system.

It is realized that the process of voluntary metric conversion by firms in a variety of industries will not be uniform across all industries or among all firms within an industry. The major emphasis of this study is to investigate the extent to which metric conversion is taking place among large firms representing a cross section of large U.S. industries. Information about industrial experiences and perceptions is believed to be useful to planners and others involved in decisions about metric

conversion. The goal is, if and when conversion is undertaken, it should not only be voluntary but also economic and efficient.

2.2 Objectives of the Study

The objectives of the survey were to measure the status and projections of metrication among large U.S. firms and industries. Specifically the areas addressed by the survey included:

- the volume of sales that are metric;
- current and potential metric production and manufacturing capabilities;
- metric planning and coordination activities;
- perceived costs and benefits;
- perceived impediments to metrication; and
- estimated time frames for metric conversion.

2.3 Survey Procedures

The population surveyed was from the Fortune 1000 listings representing the country's largest individual firms. To be included in the Fortune list, a firm must have derived more than 50 percent of its sales from manufacturing and/or mining. Two hundred and two firms were randomly sampled from that population. The sample was selected proportionately across two strata: size, as measured by sales volume, and industry grouping. The size stratum consisted of two levels: firms listed within the first Fortune 500 and firms in the second Fortune 500. Five industry groupings were defined to encompass all the firms listed by Fortune. The five groups were transportation, consumer products, manufacturing and production, aerospace and electronics, and entertainment. A two-digit designator, defined by Fortune

magazine as based on categories developed by the U.S. Office of Management and Budget, were used to place each firm in its appropriate group. Appendix A presents details of the sampling procedures.

Data were collected using a self-administered questionnaire* supplemented by telephone follow-up. The questionnaires were addressed to each company's metric coordinator, the names of whom were obtained from USMB files, files from the American National Metric Council (ANMC), and other sources. Prior to the mailout, the metric coordinators were contacted by telephone to confirm names and addresses and to introduce the survey, explain its purpose and importance, and encourage voluntary, accurate, and timely response. The information provided by the individual respondents are presented only in aggregate form.

Survey operations began on November 6, 1979, with the initial mailout of questionnaires accompanied by cover letters from the USMB Chairman and the ANMC President. Supplementary follow-up calling took place through February 8 at two levels. The first calls were to ascertain receipt of the questionnaire and remind the coordinators of the approaching deadline, clarify any questions, and provide assistance as needed. In the second level, non-respondents were asked to provide the necessary information over the phone. The second follow-up was to increase the

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* The questionnaire is reproduced as Appendix B.

level of response and to collect data omitted by some respondents. Most cases of insufficient data were from companies that returned their questionnaires uncompleted, noting that there was no conversion effort. To increase the responses and thus improve the representativeness of the study, these respondents were contacted and telephone interviews conducted accordingly.

Of the 202 firms sampled, usable data were provided by 130 respondents (64 percent). The respondents were divided: 71 from the top 500 industrial firms and 59 from the next 500 industrial firms. Table 2.1 displays the distribution of the sample and respondents.

While the response rate is better from the first Fortune 500 over the second 500, within each of these classes the distribution of responses by industry groups is close to that of the sample (see Table 2.1). A discussion of non-respondents is presented in Appendix C. Analysis of responses indicates that smaller companies were less likely to respond than were the large companies. This is evidenced by the higher response rate within the first Fortune 500 companies. It is also supported by the fact that the median and mean net sales of responding firms are greater than the comparable net sales of the non-respondents within each of the Fortune categories.

2.4 Structure of the Report

Information drawn from the survey provides a basis for measuring the extent of current metrication as well as drawing conclusions about the future. Results are reported in six sections and five appendices.

TABLE 2.1
DISTRIBUTION OF SAMPLE AND RESPONDENTS

Industry Group	Percent Distribution of Universe and Sample	Distribution of Survey Respondents[a]					
		1st 500		2nd 500		Total	
		No.	%	No.	%	No.	%
Transportation	5	5	7	2	3	7	5
Consumer Products	26	21	30	15	25	36	28
Manufacturing & Production	51	35	49	33	56	68	52
Aerospace & Electronics	15	10	14	7	12	17	13
Entertainment	2	0	0	2	3	2	2
Total	99[b]	71	70	59	58	130	64

a. Sample consisted of 101 firms for each set of 500 firms, for a total of 202 firms.

b. Does not total to 100 percent because of rounding.

- Section 3: CURRENT STATUS OF METRIC CONVERSION ACTIVITY IN SELECTED LARGE U.S. FIRMS AND INDUSTRIES describes progress in industrial conversion and discusses the perceived economic costs and benefits.

- Section 4: FACTORS WHICH MIGHT IMPEDE METRICATION defines and discusses the various impediments perceived and encountered by industry in metric conversion. These include legal and non-legal aspects, internal conflicts, and industry-wide impediments. The section also presents alternative views of companies having begun or completed metrication, stating advantages and disadvantages of metrication.

- Section 5: TIMING OF METRIC CONVERSION FOR SELECTED LARGE U.S. FIRMS AND INDUSTRIES focuses on the estimated time frames for metric conversion, including metric design and production.

- Section 6: CONCLUSIONS summarizes the most significant conclusions from Sections 3, 4 and 5.

- Appendices are:

  A. Description of Survey Plan
  B. 1979 Survey of U.S. Firms and Industries Questionnaire
  C. Data Tables
  D. Discussion of Non-Respondents
  E. Bibliography

SECTION 3

CURRENT STATUS OF METRIC CONVERSION ACTIVITY IN SELECTED LARGE U.S. FIRMS AND INDUSTRIES

3.1 Introduction and Overall Status

This section discusses the current status of metrication. While the ultimate area of interest is the end result - a metric product - metrication involves various stages and factors. In addition to studying the level of industrial metrication based on the volume and percentage of metric sales, 18 individual activities have been identified as indicative of metric action. The activities define several facets of internal organizational planning, inter-industry and individual coordination, and implementation, as follows:

Organizational Planning Activities

Issue metric policy statement
Appoint metric coordinator
Organize metric committee
Develop company metrication plan
Develop timetable for company conversion
Analyze cost of metrication

Coordinating Activities

Conduct customer surveys
Conduct supplier surveys
Coordinate with industry
Coordinate with government

Implementation Activities

Budget funds for metrication
Train employees
Inform customers and consumers
Convert data processing and related business systems
Develop metric design and engineering standards
Purchase materials and supplies in metric
Conduct research and development activities in metric language
Conduct process and production engineering in metric language.

Of the companies responding to the survey, approximately 80 percent report sales of metric products in 1978 and/or they report having at least one of the 18 metric activities planned for, under consideration, in process, or completed. However, as seen below, the extent of actual involvement in metrication depends upon the definition of metrication used.

3.1.1 Status: Percentage of Companies Selling Metric Products and Percentage of Sales of Metric Products

The extent of metrication can be viewed from two perspectives: the number of companies currently selling metric products and the actual dollar volume of total sales of metric products. Based on those companies which answered the survey question concerning the percent of their sales which were metric (112 companies), 63 percent (70 companies) reported having metric sales.

Metric production is defined at three levels of conversion -- soft, hybrid, and hard metric conversion. Soft conversion is dual labeling or noting metric equivalents with no change in the

actual dimensions. Hybrid conversion is production of both metric and customary unit parts. Hard conversion indicates a change in the actual dimension measures from customary to metric units. Section 1.2, above, contains the complete definitions.

As shown in Table 3.1, of the 112 firms responding to this question, 46 percent (52 firms) are dual labeling products, (i.e., soft conversion) while 30 percent (34 firms) and 16 percent (18 firms) of the same group are selling hard converted products and hybrid metric products, respectively. Because of the overlap (that is, firms can produce soft, hard, hybrid, or any mix of products), of the 70 companies defined as metric, about three quarters are involved in soft conversion, one-half in hard conversion, and about one-quarter hybrid conversion. A company was designated as metric or metricating if, at a minimum, it had any sales that were soft converted.

The second indicator of the extent of metric conversion, the volume of metric sales, is determined from the responses of 98 firms to questions 2 and 3 (U.S. and non-U.S. sales) and question 4 (the percent of sales which are soft, hard, and hybrid converted).* These results are displayed in Table 3.2.

Based on the available data, it is estimated that 32 percent of net sales are metric converted (soft, hybrid, or hard). Of the 112 respondents answering the metric sales question, 14 did not give sales volume data. Eleven of the 14 are classified as not

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* See Appendix B for the questionnaire.

TABLE 3.1. PERCENT OF COMPANIES SELLING SOFT-, HARD-, AND HYBRID-CONVERTED PRODUCTS IN 1978

Type of Conversion	Percent of All Companies[a]			Percent of Metricating Companies		
	Total	Top 500	2nd 500	Total	Top 500	2nd 500
Soft	46	63	26	74	81	55
Hard	30	32	28	49	42	64
Hybrid	16	23	8	26	29	18
Number of Respondents	112	62	50	70	48	22

a. Responding to question.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 3.2. VOLUME OF METRIC SALES BY TYPE OF CONVERSION

Sales Category	Total		Top 500		2nd 500	
	$ (mil)	%	$ (mil)	%	$ (mil)	%
Metric - Soft	23,033	21	21,746	22	1,286	15
Hard	6,422	6	5,711	6	711	8
Hybrid	5,422	5	5,358	5	65	1
Sub-total	34,877	32	32,815	33	2,062	24
Non-Metric	72,786	68	66,418	67	6,386	76
Total	107,663	100	99,233	100	8,430	100
Number of Respondents	98		55		43	

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

making metric products. The remaining three are defined as metricating companies. All three indicated that a portion of their sales are soft converted. Thus, the percentages of hybrid and hard converted sales may be slightly lower than those indicated in Table 3.2. As with the number of companies involved in metrication by type of conversion employed, a substantial volume of converted sales are soft metric; 21 percent of total sales or 66 percent of metric sales.

Hard metric and hybrid metric sales account for 11 percent of the total sales (6 percent and 5 percent of total sales, respectively). Comparison between the Fortune 500 and second 500 groups show a considerable difference in the average volume of metric products sold with the proportion of metric products greater in the soft category than the other two categories (Table 3.2).

3.1.2 Status: Percentage of Metric Conversion Activities Underway

Table 3.3 lists the 18 metric-related activities introduced earlier. For each metric activity, respondents were asked to indicate the current status -- (1) no plans; (2) under consideration; (3) planned; (4) in process; or (5) completed. Table 3.3 gives the percentage of those companies which responded in process or completed. The three activities most frequently mentioned as in process or completed were:

- Coordinate with industry (36.2%)
- Conduct R&D activities in metric language (34.5%)
- Appoint metric coordinator (33.0%)

TABLE 3.3. PERCENT OF COMPANIES HAVING METRIC ACTIVITIES "IN PROCESS" OR "COMPLETED" [a]

Activity	Total			Top 500			2nd 500		
	Rank	%	No. of Resp.	Rank	%	No. of Resp.	Rank	%	No. of Resp.
Coordinate with Industry	1	36.2	124	1	49.2	69	1	20.0	55
Conduct R&D Activities in Metric Language	2	34.5	119	3	47.7	65	2	18.5	54
Appoint Metric Coordinator	3	33.0	124	2	48.5	68	5	14.3	56
Develop Metric Design & Engineering Standards	4	28.1	121	6	36.9	65	3	17.9	56
Purchase Materials & Supplies in Metric	5	26.9	119	7	36.3	66	4	15.1	53
Train Employees	6.5	24.6	122	4	38.8	67	12	7.3	55
Issue Metric Policy Statement	6.5	24.6	122	5	37.3	67	11	9.1	55
Organize Metric Committee	8	23.4	120	8	33.8	65	9	10.9	55
Coordinate with Government	9	22.8	118	10.5	31.8	66	7	11.5	52
Conduct Process & Production Engineering in Metric Language	10	21.4	122	12	28.8	66	6	12.5	56
Develop Company Metrication Plan	11	20.5	122	13	28.3	67	8	11.0	55
Conduct Supplier Surveys	12	20.1	119	9	32.9	67	18	3.8	52
Convert Data Processing & Related Business Services	13	20.0	115	10.5	31.8	63	15	5.8	52
Analyze Cost of Metrication	14	17.2	112	14	26.1	65	13.5	7.1	57
Inform Consumers & Customers	15	17.1	117	15.5	23.8	63	10	9.3	54
Develop Timetable for Company Conversion	16	15.3	118	15.5	23.8	63	17	5.4	55
Conduct Customer Surveys	17	14.8	114	17	23.0	61	16	5.7	53
Budget Funds for Metric Coversion Activities	18	10.8	120	18	14.2	63	13.5	7.1	57

a. Based on respondents answering either: no plans for, under consideration, plans for, in process, or completed. Excludes those answering: not applicable, don't know, or no response.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

The three activities mentioned least often by respondents were:

- o Develop timetable for company conversion (15.3%)
- o Conduct customer surveys (14.8%)
- o Budget funds for metric conversion activities (10.8%)

Table 3.3 also displays the ranking of these 18 activities for the top 500 as well as the second 500 companies. Evidence can be seen that the larger companies are more metrically active than the second 500. Nearly half (49%) of the top 500 indicate that they are coordinating their metric activities with industry, while the highest-ranked activity for the second 500, also coordinating with industry, was checked by only 20 percent of the respondents.

Comparing only the rankings of the top 500 and second 500, we investigated whether or not these two rankings were similar, hypothesizing that similar rankings would be evidence that, although fewer smaller companies were involved in metrication, the types of decisionmaking (as indicated by similar rankings of the activities) were comparable.

We first wanted to know if the two rankings were associated. Since the two rankings were ordinal in nature, the statistic chosen was Kendall's τ, with ties.* It was found that a positive

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* For calculation details, see William L. Hays, Statistics, Holt, Rinehart, and Winston, 1963, and Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill, 1956.

correlation of 0.48 existed. Further statistical analysis** allows us to conclude that the two rankings are related. Thus, we cannot argue that decisionmaking regarding metric planning is significantly different between the top 500 and the second 500. It appears that, while the frequency distribution of metric planning activities is not the same between the two groups, the relative emphasis placed upon the different activities is similar.

Of the 130 companies responding to the survey, 60 percent are currently engaged in at least one of the listed activities, and 12 percent are at least considering or formulating plans for these activities, even though they have no activities currently underway. Twenty-eight percent of the companies have no plans for any of the activities. Finally, for each activity, a majority of the respondents checked the no plans response. The responses ranged from 50 percent having no plans to coordinate with government to 82 percent having no plans to budget funds for metric planning. It is concluded that, while most companies have at least one metric activity underway, the number actually involved in a broad range of metric planning activities is relatively small, perhaps indicating that metrication is proceeding without a great deal of the formal planning activities suggested in the questionnaire. To conduct research and development, and process and production engineering in metric language, purchase materials and supplies, and inform customers and consumers, seems

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** The significance of τ is determined by computing $Z = \frac{2(2N\ 5)}{9N(N-1)}$, N=18. If Z 1.96, we can be reasonably sure that the value of is "real."

to require some training of employees. The data indicate that companies are training employees at a rate which is comparable to the rate of the intra-company preparation underway.

The Fortune 500 and second 500 firms differ significantly in the degree of effort demonstrated regarding the implementation of metric activities. As Table 3.4 shows, of 71 companies in the Fortune 500, 79 percent have one or more activities underway. On the other hand, 44 percent of the 59 second 500 firms have no plans for all activities.

Comparable data for nine of the metric activities were obtained by the GAO and presented in the 1978 report. Although metric conversion is a voluntary process, most respondents queried in the GAO report stated they both supported metrication (at least somewhat) and felt that the changeover to the metric system was inevitable. (2) In the three years since the GAO data were obtained, the status of the nine activities has neither increased nor decreased materially. Comparisons of the current findings for the Fortune 500 and those of GAO are shown in Table 3.5. (The tenth activity of the GAO set is represented by two activities in the present study. Comparisons cannot be made directly, but the data are presented for information.) The number of Fortune 500 companies in the process of or having completed training employees has increased by about 13 percentage points, although about the same percent of companies still have no plans for employee training. Companies coordinating with government increased by eight percentage points. Other activities showed either smaller changes in both directions or no change at all.

TABLE 3.4. PERCENT OF COMPANIES HAVING NO PLANS FOR METRIC ACTIVITIES, CONDUCTING PLANNING, OR WITH CONVERSION IN PROCESS OR COMPLETED.

Status of Activities	Total	Top 500	2nd 500
No Plans[a]	28	15	44
Some Planning[b]	12	6	19
Underway[c]	60	79	37
Number of Respondents	130	71	59

a. Includes companies reporting "No Plans" for all 18 activities.

b. Includes companies reporting "Plans For" or "Under Consideration" for one or more activities, but not in process or completed.

c. Includes companies reporting "In Process" or "Completed" for one or more activities.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 3.5. PERCENT OF TOP 500 COMPANIES INVOLVED IN SELECTED METRIC ACTIVITIES: COMPARISON OF CURRENT SURVEY WITH GAO REPORT

Activity	Current Survey[a] No Plans	Plans For	Under Consideration[c]	In Process	Completed	GAO[b] No Plans	Plans For	In Process	Completed
Coordinate with Industry	35	6	(10)	42	7	32	18	45	4
Appoint Metric Coordinator[d]	43	0	(9)	3	46				
						36	7	14	43
Organize Metric Committee[d]	54	5	(8)	2	32				
Train Employees	48	8	(6)	37	2	49	25	24	2
Issue Metric Policy Statement	45	3	(15)	4	33	45	15	9	31
Conduct Supplier Survey	58	2	(8)	25	8	58	14	18	10
Coordinate with Government	52	4	(12)	29	3	58	18	23	1
Analyze Cost of Metrication	60	2	(12)	14	12	54	16	18	12
Develop Timetable for Conversion	60	6	(10)	13	11	66	14	13	6
Conduct Customer Survey	67	0	(10)	20	3	66	10	13	10
Budget Funds for Metrication	76	5	(5)	8	6	74	11	10	5

a. Approximately 93 percent of respondents (or 71 firms) gave a response for each of these activities; may not sum to 100 percent because of rounding.

b. Approximately 91 percent of respondents (or 413 firms) gave a response for each of the activities. Percents are based on these respondents. Results may not sum to 100 percent because of rounding.

c. Not included in the GAO survey.

d. The GAO survey combined, into one question, the activities: appoint a metric coordinator or organize a metric committee.

SOURCE for Current Survey: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

SOURCE for GAO: GAO Report, CED-78-128, October 20, 1978.

3.1.3 Discussion of Estimates of Metric Production Capability

Companies were asked the following question:

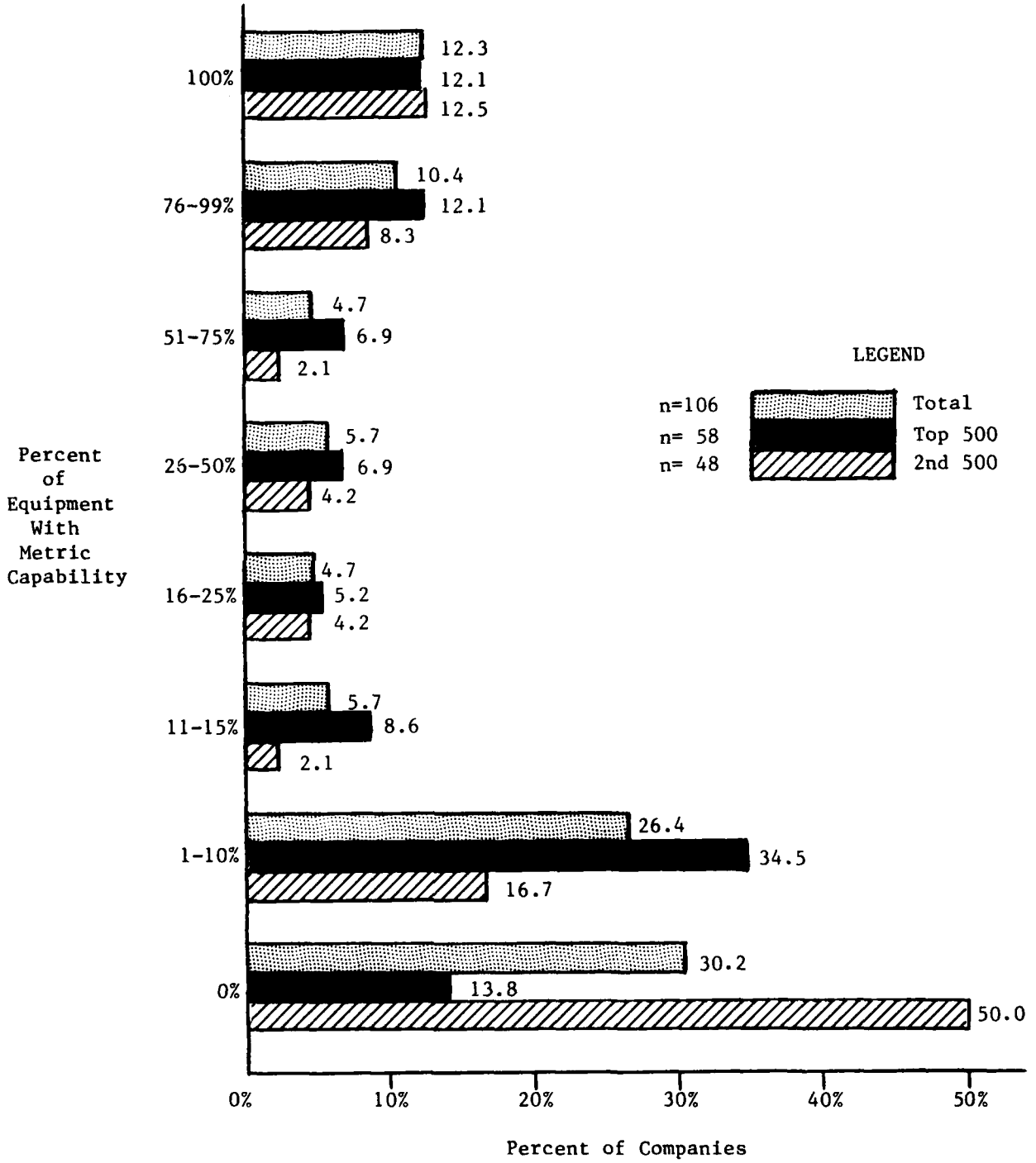
"What percent of your current manufacturing equipment has metric production, processing and/or operating capability? (Include any facilities such as refineries, power plants, etc.)."

Figure 3.1 displays the responses to this question from the 106 companies which provided an estimated percent. As shown, 30 percent of all companies reported that they had zero percent metric production capability, while only 12 percent reported that they had 100 percent metric capability. Overall, a majority of the 106 companies (57%) report that their metric production capability was ten percent or less.

On the average, then, it appears that metric production capability in U.S. companies, as measured by this percentage statistic, is low. However, this does not necessarily correlate with metric sales, as displayed in Figure 3.2. As shown in this figure, there appears to be little correlation between percent of sales which are metric (verticle axis) and percent of equipment with metric capability. This observation is confounded by the fact that the two factors are not measured in commensurable terms; i.e., metric sales are in dollars for metric products proportional to total sales dollars and metric production capacity is in terms of fractions of total production capacity. An example of this is say, 10 percent of a company's production accounting for 40 percent of total dollars of sales.

There is speculation as to what constitutes metric production capability. For example, is the ability to dual label or soft convert considered metric production capability, or is the concept of manufacturing production capability limited to the actual production of hybrid or hard converted products? Based on our

Figure 3.1. Percent of Companies With Metric Capabilities



SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

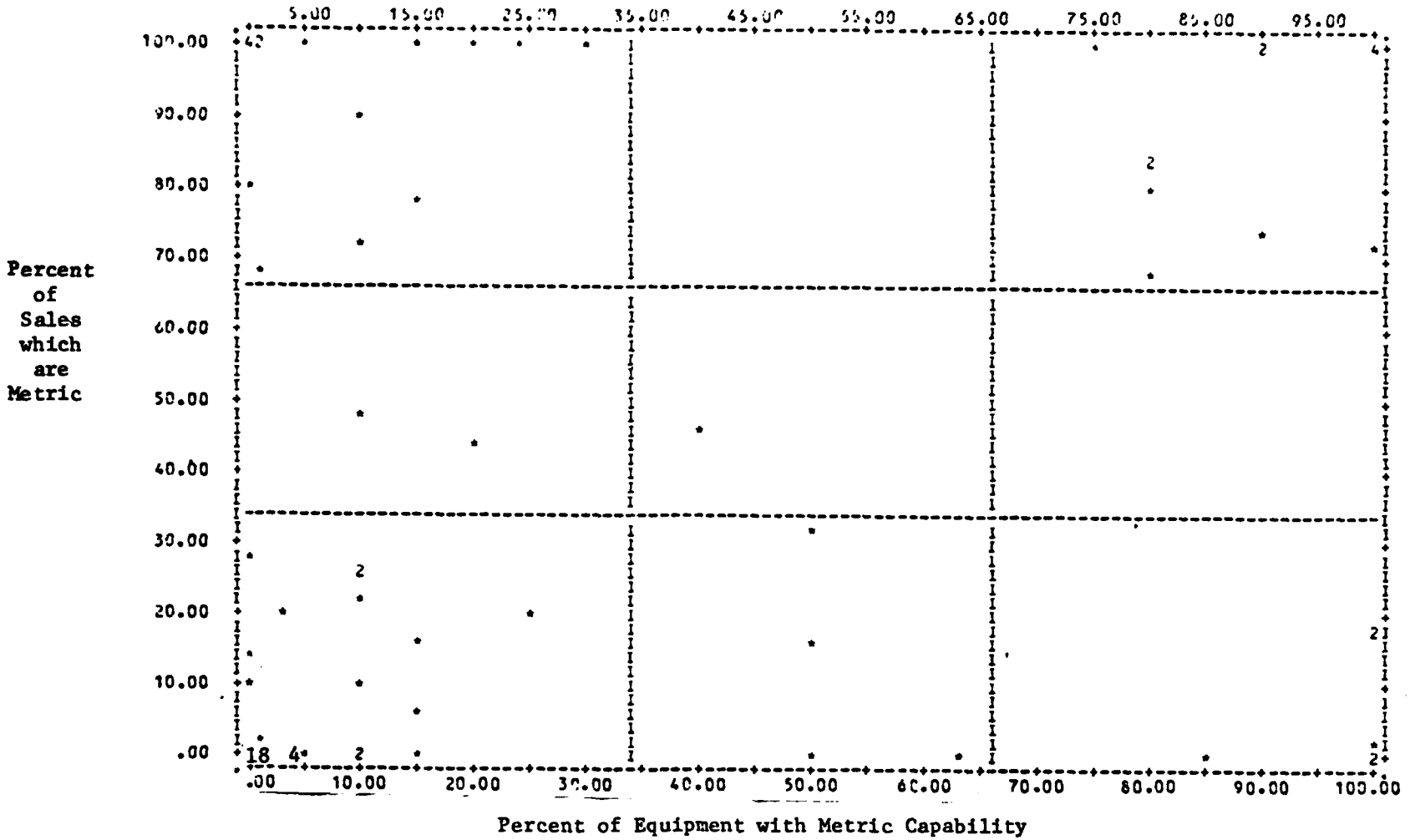


Figure 3.2. Percent of Sales Which are Metric by Percent of Equipment with Metric Capability

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

examination of individual questionnaires, it is evident that some companies do not consider soft conversion capability to be the same as metric production capability. These companies, while indicating that 100 percent of their sales are soft metric, report that their metric production capability is zero percent. Some experts feel that most processing, production and operating equipment has close to 100 percent hard or hybrid metric capability given minor adjustments. Based on that assumption, the question arises as to how to best define metric production capability. Possibly this might best be done by first examining individual product and production equipment categories. Unfortunately the current data are not sufficient to investigate this question. Further research will be necessary before it will be possible to estimate metric production capability with confidence.

3.1.4. Status: Percentage of Domestic vs. Foreign Sales

As developed in Section 3.1.1, metrication of domestic and exported products are discussed from two perspectives: the number of companies involved in metric sales and the volume of converted sales.

Of the 70 firms stating they have metric sales (domestic and/or foreign), six companies stated that their metric sales were exclusively in the domestic market while 16 firms stated that their metric sales were exclusively in foreign markets. Companies with foreign metric sales slightly outnumbered those with domestic metric sales. (See Table 3.6)

Estimated volume of total foreign versus domestic sales are derived from 113 companies providing responses to both question 2 and question 3. The total volume of foreign sales ($24.4 billion) makes up 19 percent of the total sales ($128.5 billion). The estimated volume of metric sales (domestic and foreign) is derived from 98 companies for which question 4 responses are know (percentage of metric sales). Table 3.7 presents the volume of sales that are converted by type of conversion.

TABLE 3.6. PERCENT[a] OF COMPANIES SELLING DOMESTIC/FOREIGN SOFT-, HARD-, AND HYBRID-CONVERTED PRODUCTS IN 1978

Type of Conversion	Percent of All Companies[b]		Percent of Metricating Companies[b]	
	Domestic Metric Sales	Foreign Metric Sales	Domestic Metric Sales	Foreign Metric Sales
Soft	36	40	57	64
Hybrid	21	24	33	39
Hard	13	14	20	23
Combination[c]	48	57	77	91
Number of Respondents	112		70	

a. May sum to more than 100 since more than one type of converted product may be sold by any one company.

b. Responding to question.

c. Includes all companies with soft-, hybrid-, hard-conversion or any combination of the three types.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 3.7. VOLUME OF DOMESTIC/FOREIGN METRIC SALES BY TYPE OF CONVERSION 1978

Sales Category	Total Sales		Domestic Sales		Foreign Sales	
	$ (mil)	%	$ (mil)	%	$ (mil)	%
Metric - Soft	23,033	21	17,354	20	5,679	30
Hard	6,422	6	4,145	5	2,277	12
Hybrid	5,422	5	4,207	5	1,215	6
Sub-Total	34,878	32	25,707	29	9,171	48
Non-Metric	72,786	68	62,782	71	10,004	52
Total	107,663	100	88,488	100	19,175	100
Number of Respondents	98					

NOTE: Percents are rounded. See Appendix C, Table 3: 1978 Net Sales and Metric Activity.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

The total volume of foreign sales makes up 18 percent of the total net sales, yet non-U.S. metric sales account for 26 percent of all metric sales, substantiating the argument that exported products are more likely to be metric. Stated another way, it is found that 29 percent of domestic sales are metricated and 48 percent of foreign sales are metricated. In both domestic sales and foreign markets, a much higher percentage of metric products are soft converted (20 and 30 percent) than hybrid (5 and 6 percent) or hard metric (5 and 12 percent). Soft converted products on both foreign and domestic markets make up over 60 percent of respective metric sales. Hybrid metric products are also close in the coverage of total metric sales (one-sixth of U.S. metric sales and one-eighth of foreign metric sales). Hard metric products for foreign sale make up one-fourth of all foreign converted sales whereas the U.S. sale of hard converted products accounts for one-sixth of U.S. metric sales. Table 3.8 displays the volume of domestic and foreign sales by the top 500 and second 500 firms.

3.2 Status: Metric Planning and Coordination in Selected Large U.S. Firms and Industries

Ten of the activities cited in Section 3.1 refer specifically to planning and coordination. The remaining eight imply an implementation of planning, whereby some action is taken. It is reasonable to assume that the planning activities would precede the implementation ones. However, about two-thirds of companies responding to the questionnaire stated that they have not completed or have in process any of the 18 metric activities listed. With the exception of industrial coordination, conducting R&D activities, and appointing a metric coordinator, less than one-third of the companies surveyed have initiated any given metric activity (Table 3.3). In fact only one-third of the activities have more than 25 percent of the firms involved.

TABLE 3.8. VOLUME OF DOMESTIC/FOREIGN METRIC SALES BY TOP 500 AND SECOND 500 IN 1978

Sales Category	Domestic Sales				Foreign Sales			
	Top 500		2nd 500		Top 500		2nd 500	
	$ (mil)	%	$ (mil)	%	$ (mil)	%	$ (mil)	%
Metric - Soft	16,147	20	1,207	16	5,599	30	79	11
Hard	3,716	5	427	6	1,993	11	284	39
Hybrid	4,148	5	60	1	1,210	7	5	1
Sub-total	24,011	30	1,693	22	8,802	48	368	51
Non-Metric	56,771	70	6,013	78	9,648	52	356	49
Total	80,782	100	7,706	100	18,450	100	724	100
Number of Respondents	55		43		55		43	

NOTE: Percents are rounded. See Appendix C, Table 3: Net Sales and Metric Activity.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

As was established earlier (section 3.1.1), 63 percent or 70 companies are currently metricating to some degree as opposed to 37 percent or 42 firms which are not. Table 3.9 shows that 77 percent of the metricating firms have one or more activities in process or completed. An additional six percent are planning or considering various metric activities. Seventeen percent, however, while already converting, have not become involved in any metric activities and have no plans to do so.

It would appear that there is a lack of planning and coordination for metrication. However, it is not readily apparent from these data if companies are converting without any "formal metric planning" per se or if the planning is considered as an everyday normal business activity without specific reference to metric planning. Table 3.10 provides further evidence that a question as to the nature of metric planning exists. As one can see, less than half of the metricating companies have initiated any given metric activity.

The basic patterns found in Section 3.1.2 hold true for metricating companies insofar as the same activities with the greatest number of all companies involved have the greatest proportion of metricating companies involved. The interesting difference occurs between metricating and non metricating companies. It may be that metricating tends to by-pass organizational planning activities, except appointing a metric coordinator; the metric committee, policy statement, company plan, and company timetables all are ranked at a lower level than are the same activities ranked by non-metricating companies. It should be noted that the percentage of non-metricating companies with in process or completed status is less than five percent for all activities, other than appointing a metric coordinator, coordinating with industry, and issuing a metric policy statement, which are ranked first, second and third, respectively.

TABLE 3.9. PERCENT OF METRICATING AND NON-METRICATING COMPANIES HAVING NO PLANS FOR METRIC ACTIVITIES, CONDUCTING PLANNING, OR WITH CONVERSION IN PROCESS OR COMPLETED

Status Category	Percent of Metricating Companies			Percent of Non-Metricating Companies		
	Total	Top 500	2nd 500	Total	Top 500	2nd 500
No Plans[9]	17	10	32	60	43	68
Some Planning[10]	6	2	14	19	7	25
Underway[11]	77	88	54	21	50	7
Number of Respondents	70	48	22	42	14	28

[9] Includes companies reporting "No Plans" for all 18 activities.

[10] Includes companies reporting "Plans for" or "Under Consideration" for one or more activities, but not in process or completed.

[11] Includes companies reporting "In Process" or "Completed" for one or more activities.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 3.10. PERCENT OF METRICATING COMPANIES INVOLVED IN METRIC ACTIVITIES

Activity[a]	No Plans	Plans for[b]	Underway[c]
Coordinate with Industry	37	14	49
Conduct R&D Activities in Metric Language	41	11	48
Appoint Metric Coordinator	45	13	42
Coordinate with Government	51	12	37
Purchase Materials and Supplies in Metric	52	12	36
Design Metric Design and Engineering Standards	46	19	35
Issue Metric Policy Statement	50	15	35
Train Employees	54	14	32
Organize Metric Committee	55	13	32
Conduct Supplier Survey	63	6	31
Develop Company Metrication Plan	51	19	30
Conduct Process and Production Engineering in Metric Language	59	14	27
Analyze Cost of Metrication	57	17	26
Convert Data Procesing and Related Business Systems	63	12	25
Inform Consumers/Customers	63	12	25
Conduct Customer Surveys	66	9	25
Develop Time Table for Company Conversion	61	16	23
Budget Funds for Metric Conversion Activities	73	13	14

a. Approximately 92 percent of the 70 metricating companies gave a response for each of these activities. Percents are based on these respondents.

b. Includes responses to both "Plans for" and "Under Consideration."

c. Includes responses to both "In Process" and "Completed."

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

One cannot say if the lack of planning and coordination is a positive or negative factor. There is metrication taking place, regardless of the status of metric planning and coordination activities. Respondents were asked to state factors which they felt impeded metrication. Responses came from both metricating and non-metricating companies. In Table 3.11, major areas of perceived impediments are given with the status of related coordinating or planning activities. For companies seeing each of the factors as impediments, less than half have engaged in related metric activities. The full spectrum of legal and non-legal impediments is discussed in more detail in Section 4. It is possible that perceptions regarding some impediments to current or future metrication might arise from the lack of planning or coordination.

3.3 Economic Costs and Benefits of Metric Conversion in Selected U.S. Firms and Industries

Companies having begun metrication were requested to give their reasons for metricating, describe the benefits they derived, and provide suggestions for metrication or indicate what they would do differently were they to begin over. Respondents who are designing hybrid metric or hard metric new products were also asked to indicate how the costs incurred compare to current design costs of non-metric products.

New products are being designed as hard metric by 31 companies out of 100 and as hybrid metric by 16 out of 99 companies. In total, 41 companies report designing new products as hard, hybrid or both. Table 3.12 shows the number of companies reporting new product metric design and the estimated costs related to new products. About half the companies (19) indicate that design

TABLE 3.11. PERCENT OF COMPANIES INVOLVED IN SELECTED METRIC ACTIVITIES RELATED TO PERCEIVED IMPEDIMENTS TO METRICATION

Impediment/ (Activity)	Number of Resp.[a]	No Plans	Plans for[b]	Underway[c]
Customer Demand/ (Conduct Customer Survey)	60	70	8	22
Industry-wide Standards/ (Coordinate with Industry)	37	46	11	43
Suppliers/ (Conduct Supplier Surveys)	32	59	3	38
Cost of Metrication/ (Analyze Cost of Metrication)	29	59	14	27

a. Reduced base number of companies reporting given impediment. Excludes companies reporting impediment but not reporting activity. Total bases: customer demand: 66; industry-wide standards: 38; suppliers: 32; cost: 30.

b. Includes responses to "Plans for" and "Under Consideration."

c. Includes responses to "In Process" and "Completed."

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 3.12. COMPARISON OF ESTIMATED METRIC DESIGN AND MANUFACTURING COSTS TO CURRENT COSTS

Activity	Number of Resp.[b]	Percent of Respondents Estimating Costs As:[a] About the Same	Somewhat Greater	Much Greater	Don't Know
Design Costs					
Hard Metric	25	44	20	0	36
Hybrid Metric	10	50	20	10	20
Both	6	50	50	0	0
Total	41	46	24	2	27
Manufacturing Costs Over Production Life					
Hard Metric	25	50	10	0	40
Hybrid Metric	10	50	20	10	20
Both	6	83	17	0	0
Total	41	54	15	2	29

a. No company stated that costs were somewhat or much less.

b. Includes companies who have new products designed as hard metric, hybrid metric, or both.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

costs are about the same for metric products as for current customary design. The same holds true for manufacturing costs over the production life. However, none of the companies responding to the designing or manufacturing of new metric products estimated costs to be less than costs* for current customary designing and manufacturing. As Table 3.12 shows, there is little deviation between estimated costs of metric design or manufacturing for either hybrid or hard metric.

The GAO report presented similar data. Respondents to that survey were asked to rate on a Likert scale the anticipated impact of metric conversion on prices. While the GAO did not specify exact percentages, approximately 65 percent estimated no impact on prices, while approximately 25 percent anticipated prices to be somewhat higher.

In the survey of the Fortune 1000, none of the companies having begun metrication responding to questions 9A and B indicated that cost itself was either a reason for metrication or a derived benefit, though some responses could be construed as related to economic factors.

Reasons given for metrication by 67 companies included:

40% meeting international standards or because the metric system is internationally accepted

36% meeting customer demand for metric products

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* See Appendix C, Table 10.

18% keeping pace with accepted industry practice or standards

13% meeting government specifications regarding the metric system

12% keeping pace with suppliers who are already metric

9% the metric system is easier to use

6% metrication results in reduced inventory.

Half of the metricating companies stated there were no visible benefits, or they had yet to be determined. Most of the benefits of metrication that were reported result from the above mentioned reasons. The most frequently mentioned benefit of metrication is the maintenance of market coverage, especially in foreign markets. Reduction of inventory and an easier method of calculation resulting in fewer errors were also quoted as benefits of converting to the metric system.

Of the metricating companies responding to question 9C (suggestions for metrication), 30 out of 60 said that they would do nothing differently were they to begin metrication again. Suggestions for metrication reported narrowed down to three major areas:

- o timing
- o planning
- o industry-wide encouragement to metricate

Most respondents who indicated time frames suggest that they would have preferred to have shortened the conversion time. The greatest proportion (18 percent) of suggestions are regarding planning.

SECTION 4
FACTORS WHICH MIGHT IMPEDE METRICATION

With approximately 37 percent of the sampled companies presently manufacturing no metric products, it is relevant to explore perceived inhibitions to metric conversion. These impediments arise from both the legal environment and non-legal circumstances. Each is discussed in the following sections.

4.1 Legal Impediments

Legal impediments to metrication are found in a great number of citations and subsequent references to existing English measurement units imbedded in laws and regulations at every level of government. According to research and analysis of these regulations published in 1979 in the Middlesex Report (5), the references to specific units constitute legal constraints of three types -- legal barriers, deterrents, and nuisances, defined as follows:

- Legal barriers - A legal barrier exists when a law or regulation prohibits the use of metric units or metric sizes.

- Legal deterrents - A legal deterrent exists when a law or regulation makes it costly, cumbersome, or difficult to use metric units or measurements.

- Legal nuisances - A legal nuisance exists when a law or regulation hampers the use of metric units or sizes.

While many industrial authorities apparently believed numerous imbedded references to measurement units constitute legal barriers, when examined closely, very few were found by Middlesex to be actual barriers. The vast majority of the legal restrictions are defined to be legal deterrents and nuisances as opposed to barriers. While it is important to recognize that different degrees of impediment caused by laws and regulations exist, respondents to this survey were only asked to note "which of the following laws or regulations (these are listed below), if any, currently inhibit conversion by your company to the metric system?" References to impediments or inhibitions will be used synonymously with the terms barriers, deterrents, and nuisances. Based on the findings of the Middlesex Report, however, we assume that the bulk of inhibiting legalities specified in this report are actually legal deterrents or nuisances. (5)

Overall, as seen in Table 4.1, 52 percent of all firms reported that none of the stated laws and regulations currently inhibited the metric process, and an additional 16 percent did not know, suggesting that if any laws were of an inhibiting nature, the degree of such must be negligible. The remaining 32 percent felt that one or more of the following classes of regulations in some way inhibit metric conversion:

- o U.S. Federal/State procurement regulations
- o Building codes
- o State/local laws
- o U.S. Antitrust laws
- o Other U.S. Federal laws or regulations

TABLE 4.1. PERCENT OF COMPANIES CITING LEGAL IMPEDIMENTS TO METRICATION, BY SIZE AND INDUSTRIAL GROUP

Response	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Mfging & Production	Aerospace & Engineering
Legal Impediments[b]	32	45	21	29	27	34	35
No Legal Impediments	52	44	63	57	61	48	53
Don't Know	16	11	16	14	12	18	12
Total Percent	100	100	100	100	100	100	100
Number of Respondents	130	71	59	7	36	68	17

a. Entertainment companies are not presented separately since only two responded. Their responses are included in the totals.

b. For breakdown by type, see Appendix C, Table 8.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

The manufacturing and production industries and consumer products industries noted with the most frequency that State and local laws were inhibiting. Closely following are building codes, cited by 16 percent of all respondents, 20 percent of the Fortune 500, and 11 percent of the second 500. Other Federal laws and regulations were the third most frequently mentioned by all industries as well as the top 500. Although most responses did not specify a particular regulation, several did note regulations pertaining to packaging and labeling. Interestingly, the Fair Packaging and Labeling Act (FPLA), PL 89-755 (15 USC 1451 and 16 CFR Part 500), was cited in the Middlesex research report as one of the perceived legal barriers, when in fact it falls under the heading of legal deterrent. Federal antitrust laws were cited by only firms categorized as from the manufacturing and production industry and within the Fortune 500 (see Appendix C, Table 8).

The incidence of perceived legal impediments were also examined in 1976 in the course of the GAO study. Table 4.2 compares GAO findings with those of this study.

Although approximately the same percent of companies in 1979 (44%) perceived no legal impediments as did so in the GAO report (41%), most of the regulations and laws listed exhibit slightly higher percentages of companies perceiving them as impediments in 1979. Only in the category of Federal antitrust laws did the percent of companies indicating them as perceived inhibitions decrease in 1979.

TABLE 4.2. COMPARISON BETWEEN GAO AND CURRENT SURVEY RESULTS OF COMPANIES CITING LEGAL IMPEDIMENTS TO METRICATION (PERCENT)

Perceived Impediment	Current Survey	GAO
State/local laws	24	17
Building codes	20	15
Other U.S. laws	19	14
U.S. Federal/state procurement	11	10
Federal antitrust	9	12
Other	Not Available	7
None	44	41
Don't Know	16	Not Available
Number of Respondents	71	413

NOTE: Sums are greater than 100 percent, since multiple responses were possible.

SOURCE of Current Survey: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

SOURCE of GAO Data: GAO Report, CED-78-128, October 20, 1978.

There is some evidence that the perception of legal impediments to metric conversion may be positively related to company involvement with coordinating metric planning and/or implementation with government. Even more evidence points to a correlation between lack of government coordination and perceiving no legal impediments. The relationships between the perception of legal impediments and coordination with government are displayed in Tables 4.3 and 4.4.

As can be seen, there is a slightly higher percentage of companies coordinating with government and seeing legal impediments (44%) than those coordinating with government and seeing no legal impediments (41%). This is seen more dramatically for the Fortune 500 group (Table 4.4). Although there are still a number of companies who reported legal impediments and have no plans to coordinate with government, one should note the status of government coordination is "no plans" for 64 percent of the companies citing no inhibiting laws or regulations (that is 42 of 66 firms; Table 4.3). Only 17 percent (or 11) of those companies who perceived no legal impediments coordinated with government. There is also a difference between metricating and non-metricating companies (see Table 4.5).

Viewed from one perspective, it seems that legal impediments are perceived by more metricating companies than by non-metricating companies. In fact, over two-thirds of the firms perceivng legal impediments are metricating (28 of 41). On the other hand, of the 70 metricating companies, less than 50 percent perceived legal impediments.

TABLE 4.3. NUMBER OF COMPANIES PERCEIVING LEGAL IMPEDIMENTS, VERSUS STATUS OF GOVERNMENT COORDINATION

Response	No Plans for Coordinating With Government		Coordination With Gov't. in Process or Completed		Other		Total	
	Number	%	Number	%	Number	%	Number	%
Legal Impediments	17	23	12	44	12	41	41	32
No Legal Impediments	42	57	11	41	13	45	66	51
Don't Know	15	20	4	15	4	14	23	18
Total	74	100	27	100	29	100	130	100

NOTE: Sums may be more than 100 percent because of rounding.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 4.4. COMPANIES PERCEIVING LEGAL IMPEDIMENTS BY STATUS OF COORDINATION WITH GOVERNMENT AND SIZE OF COMPANY

Status of Legal Impediments	Top 500						2nd 500						Total	
	No Plans for Coordinating With Gov't.		Coordination With Gov't. in Process or Completed		Other		No Plans for Coordinating With Gov't.		Coordination With Gov't. in Process or Completed		Other			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Legal Impediments	10	29	11	52	7	44	7	18	1	17	5	38	41	32
No Legal Impediments	17	50	7	33	7	44	25	62	4	67	6	46	66	51
Don't Know	7	21	3	14	2	12	8	20	1	17	2	15	23	18
Total	34	100	21	99	16	100	40	100	6	101	13	99	130	101

NOTE: May not sum to 100 percent because of rounding.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 4.5. PERCEPTION OF LEGAL IMPEDIMENTS BY STATUS OF METRICATION

Status of Legal Impediments	Metricating Companies		Non-Metricating Companies		Status Unknown		Total	
	No.	%	No.	%	No.	%	No.	%
Legal Impediments	28	40	7	17	6	33	41	32
No Legal Impediments	31	44	30	71	5	28	66	51
Don't Know	11	16	5	12	7	39	23	18
Total	70	100	42	100	18	100	130	101

NOTE: May not sum to 100 percent because of rounding.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

4.2 Non-Legal Impediments

There was overwhelming response to the question regarding non-legal bariers to metric conversion from metric and non-metric companies alike. By every classification, at least 80 percent of the respondents named at least one non-legal impediment to conversion. While the responses varied in scope and detail, nearly all reflected two broad areas of concern: internal conflicts and external restrictions. Based on the variety of responses, these two general classes can be further detailed to identify specific factors inhibiting metrication. The responses included under the heading of internal conflicts reflect a wide range of concerns. The most prevalent is cost. The high rate of responses referring to external factors suggest exploration of the interactions along market stages (supplier through user) as well as among the hierarchical dimensions.

4.2.1 Internal Conflicts

Of the 224 responses (more than one factor could be provided by each responding firm) regarding non-legal inhibitions, 30 percent (67 responses) were related to restrictions arising within a company's operational framework. The cost factor accounts for nearly 50 percent of the 67 responses related to the firms' internal operations. Reference to cost is distributed across the board, with most companies feeling that the return on the investment in metric conversion will not be financially beneficial. However, a majority of the companies answering the new product design and manufacturing cost question said that the costs incurred were about the same as for design of customary items. (See Table 3.12.) This also holds true across all industry types.

Of the companies stating cost as an inhibiting factor (23 percent of the 130 respondents), almost 60 percent (18 firms) have no plans for analyzing the cost of metrication, 14 percent (4 firms) are considering the possibility or have plans, and 27 percent (8 firms) have cost analyses in process or completed. On the other hand, of the total number of companies who have performed cost analyses (21), 38 percent did indeed cite cost as a barrier.

The remaining responses regarding internal restrictions reflect a wide variety of aspects. These include such areas as:

- o planning and engineering
- o training employees to adequately cope with a new system of measurement
- o replacing old equipment with new
- o increasing effort of dual labeling.

Most of these also reflect a financial element but additionally they require time and effort that, from a management standpoint, may not be feasible. Several companies indicated that other activities within the organization are of a higher priority and prefer to expend time and money on those projects over metric conversion. Others simply question the need to convert.

4.2.2 External Factors

Hinderances presented by external forces were by far the most frequently mentioned. Impediments arising from the lack of industry-wide standards and coordination, individual suppliers, and individual customers account for 61 percent (136 responses of the 224) of the total responses to non-legal barriers. Industry apparently sees itself as the middleman in the effort to

metricate. Companies apparently believe they cannot proceed with a full scale conversion operation without parallel efforts from the suppliers and equal effort from the end user and acceptor of their finished products. Most companies see themselves as merely one segment in a series of functions. Three general groups were repeatedly mentioned:

- o customers
- o suppliers
- o industry-wide associations

The subsections will explore these factors.

4.2.2.1 Customer Demand and Suppliers

Foremost among perceived external impediments is that of customer demand or acceptance. A number of responses (29%) referred to customer related delays in conversion. In some cases, companies noted that, even in foreign markets, products were well accepted despite non-metric status. A total of 51 percent (66) of the respondents stated that they would convert when their customers demanded a metric product. Similarly high percentages were evident among the Fortune 500, second 500, and all industry groups. However, of the companies reporting customer demand as impeding metrication, 68 percent have no plans to conduct a customer survey, eight percent are considering or planning it, and 20 percent are in the process or have completed such studies. With only 20 percent of the responses alleging customer impediments supported by customer surveys, it is not evident how companies would become aware of changes in customer demand for metric products, were they to develop. There is evidence, however, that customers may indeed deter conversion, substantiated by 85 percent of the 17 companies that have conducted customer surveys and still feel customers hinder their metrication.

At the opposite end of the spectrum are obstacles presented by suppliers. Without raw meterials, components, or product-related supplies and equipment, plans for metrication are more or less "nipped in the bud." The statistics regarding companies hindered by suppliers versus companies performing studies related to suppliers follow the same pattern as with customer barriers. In total, 25 percent of the 130 respondents referred to suppliers as inhibitors. Of the 24 who conducted supplier surveys, 50 percent cited suppliers as an obstacle to metrication. Apparently, the number of companies seeking information about customer and supplier attitudes about metrication is related to company perceptions of impediments, although we cannot tell from the data whether perceptions of impediments preceded or were followed by customer and supplier surveys.

4.2.2.2 Industry-wide Factors

The previous discussion leads one from the market stages to that of hierarchical development. The consistent second runner to customer demand is the barrier created by the presence of an "authority" encompassing a group of related firms. When the problem of supplies and customers is equitably resolved, according to many, there would still be industry-wide standards to contend with. Many firms are affected by industry standards. It is believed that a coordinated changeover can only occur through revision or coordination by industry-wide associations or trade groups which would recognize both the producers and users of metric products.

Once again, the magnitude of coordination is explored. Twenty-nine percent of the 130 companies mentioned an industry-wide barrier, 35 percent of the top 500, and 22 percent of the second 500. Industry groups range from 43 percent (transportation) to 25 percent (consumer products).

There are no data to determine the number of companies or industry classes, that have the pace and degree of metrication dictated by an industry or trade association. Several respondents referred to an association, indicating that it was through this organization that their metric progress was monitored.

In total, 45 percent of all companies are currently coordinating with industry, (one of the 18 metric activities discussed in 3.1.2), of which 36 percent or 16 companies indicate industry-wide restrictions. On the other hand, of the total companies citing industry-wide barriers, 43 percent are cordinating.

As was stated in the opening paragraph of this subsection, non-legal impediments are perceived by both metricating and non-metricating companies. Of the total 130 respondents, only seven did not see hindrances to metric conversion; 10 did not respond. (See Table 4.6.) Nearly 9 out of 10 companies of both the metricating and non-metricating status referred to at least one non-legal factor which currently inhibits metrication. The frequency of companies quoting particular factors does not vary much between metricating and non-metricating companies. Cost factors related to conversion were perceived as inhibiting metrication by a somewhat higher percent of non-metricating companies than those having begun metrication. However, the other non-legal impediments to metrication were all cited by a consistently higher percentage of metricating companies than non-metricating companies.

TABLE 4.6. PERCENT OF METRICATING AND NON-METRICATING COMPANIES PERCEIVING NON-LEGAL IMPEDIMENTS TO METRICATION BY TYPE OF NON-LEGAL IMPEDIMENT

Non-Legal Impediment	Metricating Companies		Non-Metricating Companies		Status Unknown	
	No.	%	No.	%	No.	%
Customer Demand	36	51	19	45	11	61
Industry Standards	26	37	9	21	3	17
Internal Conflicts	20	29	9	21	5	28
Supplier	18	26	8	19	6	33
Cost Elements	14	20	10	24	6	33
Non-Mandatory	8	11	2	5	1	5
Other	3	4	6	14	1	5
None	4	6	2	5	1	5
No Answer	6	8	3	7	1	5

NOTE: Sum of respondents is greater than number of metricating companies (70), non-metricating companies (42), and unknown status companies (18) as multiple responses were possible.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

SECTION 5
TIMING OF METRIC CONVERSION IN SELECTED LARGE U.S. FIRMS AND INDUSTRIES

Discussion of time frames for metrication focuses on two general areas. One is exploration of the timing of the 18 metric activities, the status of which were presented in Section 3. The other area is estimates of the time frames for metric conversion. Three estimates were elicited -- realistic, minimum, and preferred.

5.1 Planning Time Frames

For each metric activity in process or completed, respondents were requested to specify the starting date as well as actual or estimated year of completion. For every activity, the majority of respondents both in the Fortune 500 and second 500 began or completed the activity between 1976 and 1979.

5.2 Implementation Time Frames

Survey respondents were requested to estimate the time it would take their companies to convert to the metric system. Time frames based on three criteria were investigated. The first criterion, designated realistic time frames, assumes no significant change in the current rate of voluntary metrication progress in the United States. The second criterion, designated minimum time frame, is based on the assumption that extreme pressure to voluntarily metricate would be exerted on the company (e.g., by customers, suppliers, environment, etc.). The third criterion, designated preferred time frame, simply requests the respondent

to report the number of years which the company prefers to take to convert. Four relevant statistics regarding the years to convert under the three circumstances are presented in Table 5.1. Due to the diversity in the reported range of years required or desired to convert, the median and mode responses are felt to be the most descriptive.

Twenty-six companies said that, under realistic conditions, they will never go metric. For the realistic case, both the mode (the most frequently mentioned number of years) and median (the point at which 50 percent of the responses fall above and below) number of years is 10. Of the 99 companies, (the number responding to this question, including those that said "never") 39 percent anticipate that metric conversion will occur within their companies in 10 years or less (or 53 percent of the 73 companies reporting a specific time).

Based on current attitudes, level of metrication, and progressive planning and coordination, one might expect that the Fortune 500 firms would estimate that metrication could take place within a slightly shorter time period than the estimates of the second 500 firms. As Table 5.2 shows, however, while more companies in the second 500 (15 or 33 percent) stated they would never go metric than did the Fortune 500 (11 or 20 percent), the median number of years required to become metric was two years less for the second 500.

There are no great differences among industry groups with respect to median and mode times to convert under the realistic case, except for the modes for the consumer products group (see Appendix C, Table 6). However, differences do show up when the realistic time distributions are assessed. One-third of the respondents in the consumer products industry estimate that they will realistically convert within 5 years compared to less than 15 percent in any other group.

TABLE 5.1. ESTIMATED TIME FRAMES FOR METRICATION

Time Frame	Mean[a] (Years)	Mode[b] (Years)	Median[c] (Years)	Range (Years)	No.[d]
Realistic	15.1	10	10	0-100	73
Preferred	11.7	10	8	0-100	45
Minimum	4.2	5	3	0-25	96

a. Mean: sum of all responses divided by number of companies responding.

b. Mode: response most frequently mentioned.

c. Median: the point at which 50 percent of the responses fall above and below.

d. Includes the companies reporting a specific number of years to convert. "Never" and "don't know" responses are excluded.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 5.2. PERCENT OF COMPANIES REPORTING ESTIMATED REALISTIC TIME FRAMES FOR METRICATION

Realistic Time Frame	Total	Top 500	2nd 500
0 to 5 years	17.2	11.1	24.4
6 to 10 years	22.2	25.9	17.8
11 to 15 years	12.1	18.5	4.4
16 to 20 years	10.0	9.3	11.1
Over 20 years	12.1	14.8	8.9
Never	26.3	20.4	33.3
Total number of respondents	19	54	45
Mean number of years	15.1	15.7	14.2
Median	10	12	1
Mode	10	10	5, 10[a]
Range	0-100	0-75	0-100
Number of respondents for statistics	73	43	30

a. Bimodal, that is, two times occupy the most frequently mentioned position.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

The number of years in which companies would prefer to convert are somewhat less than those under the realistic conditions. The median for the total group decreased by two years from the estimate under realistic conditions. The percentage of companies preferring to become metric within a ten year time period shows a six percentage point increase over the realistic case estimate. Approximately 29 percent of the companies responding would prefer to go metric in five years or less. This figure is outweighed, however, by the fact that 25 companies would prefer to never go metric. As shown in Table 5.3, the mode and median number of years for preferred conversion is 5 years for the second 500 compared to 10 and 9 years respectively for the Fortune 500. Preferred time frames among industry groups are fairly evenly distributed, again with the consumer products group responding a little at variance with the others (see Appendix C, Table 6).

Minimum time frames for metrication are considerably lower than time frames estimated under either the realistic or the preferred circumstances (see Table 5.4). A small number of firms (seven of the 103 respondents, two of the 59 Fortune 500 and five of the 44 second 500) stated that they will never convert despite extreme pressure (minimum time frame). The most frequently stated reasons given by these firms were internal company conflicts and customer related barriers (four and three, respectively). However, over all industries and within each industry group alike more than 75 percent (77 percent for the second 500 and 80 percent for the first Fortune 500) indicated that metric conversion could take place in five years or less. For all categories (Fortune 500, second 500 and the industry groups), the mean, median and mode statistics are five years or less.

TABLE 5.3. PERCENT OF COMPANIES REPORTING ESTIMATED PREFERABLE TIME FRAMES FOR METRICATION

Preferable Time Frame	Total	Top 500	2nd 500
0 to 5 years	28.6	27.8	29.4
6 to 10 years	17.1	22.2	11.8
11 to 15 years	8.6	13.9	2.9
16 to 20 years	2.9	5.5	0
Over 20 years	7.1	2.8	11.8
Never	35.7	27.8	44.1
Total number of respondents	70	36	34
Mean number of years	11.7	9.4	14.8
Median	8	9	5
Mode	10	10	5
Range	0-100	0-25	0-100
Number of respondents for statistics	45	26	19

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

TABLE 5.4. PERCENT OF COMANIES REPORTING ESTIMATED MINIMUM TIME FRAMES FOR METRICATION

Minimum Time Frame	Total	Top 500	2nd 500
0 to 5 years	78.6	79.7	77.3
6 to 10 years	11.6	13.5	9.1
11 to 15 years	1.0	1.7	0
16 to 20 years	1.9	0	2.3
Over 20 years	1.0	1.7	0
Never	6.8	3.4	11.3
Total number of respondents			
Mean number of years	4.2	4.7	3.6
Median	3	4	2
Mode	5	5	1
Range	0-25	0-25	0-20
Number of respondents for statistics	96	57	39

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

Estimated minimum and preferred time frames by the Fortune 500 can be compared to similar estimates elicited from the same universe three years ago. In the GAO report, respondents were asked to estimate minimum and optimum timing for metric conversion.* Of the approximately 415 respondents to the GAO survey, 82 percent reported conversion within a 10 year minimum time frame, compared to 93 percent of the Fortune 500 respondents to this survey. Preferable or optimum time estimates show that 62 percent of GAO respondents said 10 years or less compared to 50 percent of the responding Fortune 500 companies in this survey. The reader should be cautioned that when comparing these statistics, they should be aware that the respondents were answering somewhat different questions. (See Appendix B, questions 6B and 6C for comparison with the GAO questions.)

5.3 Future Projections

Table 5.5 presents the percent of new products designed as being metric. As can be seen, the Fortune 500 and second 500 firms design new products in approximately the same proportions regardless of the type of conversion. However, the Fortune 500 group exhibits a higher frequency of all conversion type designs. The largest difference between the two groups is for the hard metric product. The number of responding firms was 100 for the non-metric and hard metric data, and 99 for the soft and hybrid data.

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* The two relevant questions asked in the GAO survey were:

"If the United States converts to the metric system, approximately what would be the shortest time frame for your company to convert?" and "If conversion is not made mandatory, what would be the optimum amount of time your company would need to convert?"

TABLE 5.5. AVERAGE PERCENT OF NEW PRODUCTS BEING DESIGNED AS METRIC

Product Design	Total	Top 500	2nd 500
Non-Metric	66	59	76
Soft Metric	16	18	12
Hard Metric	13	17	8
Hybrid Metric	5	6	3

NOTE: May not sum to 100 percent because of rounding.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

Comparison between findings of this survey regarding the number of companies designing new products as metric and those of the GAO report (2) reveals that new product metric design has increased as shown in Table 5.6.

Fortune 500 firms responding to GAO survey in 1976 were asked "the extent to which metrics were used in engineering drawings in the U.S." In the current survey, however, companies were asked to what extent new products are being designed as metric. Table 5.6 displays the results of both surveys. It should be noted that the survey instruments employed by the current survey and GAO are different and the reader should view the statistics accordingly. Whatever the differences, however, it does appear that more companies in this survey are primarily designing new products in metric and fewer use predominately non-metric drawings or design.

Companies were requested to estimate the percentage of future acquisitions of equipment and facilities that would have metric production, processing, and/or operating capability over the next six years or more (see Appendix B, Question 7B). It was noted in Section 3.1.3 that 12 percent of the companies responding currently have manufacturing equipment and facilities with 100 percent metric production capability. As Figure 5.1 shows, it is anticipated that by next year the percent of companies with 100 percent metric capability will increase to just over 15 percent, by the next 2 to 5 years to 20 percent, and by the next 6 years or more to 41 percent.

TABLE 5.6. COMPARISON OF CURRENT SURVEY DATA WITH GAO DATA [a] FOR PERCENT OF FORTUNE 500 COMPANIES USING METRIC DESIGN

Product Design	Current Survey: Mean Percentage of New Products	Current Survey: All New Products [b] (% of Companies)	Current Survey: Number of Resp.	GAO [c] (% of Responding Companies)
Non-Metric	59	39	56	84
Soft Metric	18	9	56	12
Hard Metric	17	9	57	2
Hybrid Metric	6	2	56	2
Combination	100	59		100

a. GAO data adjusted to make results compatible with current survey results by excluding non-respondents and those responding "Not Applicable."

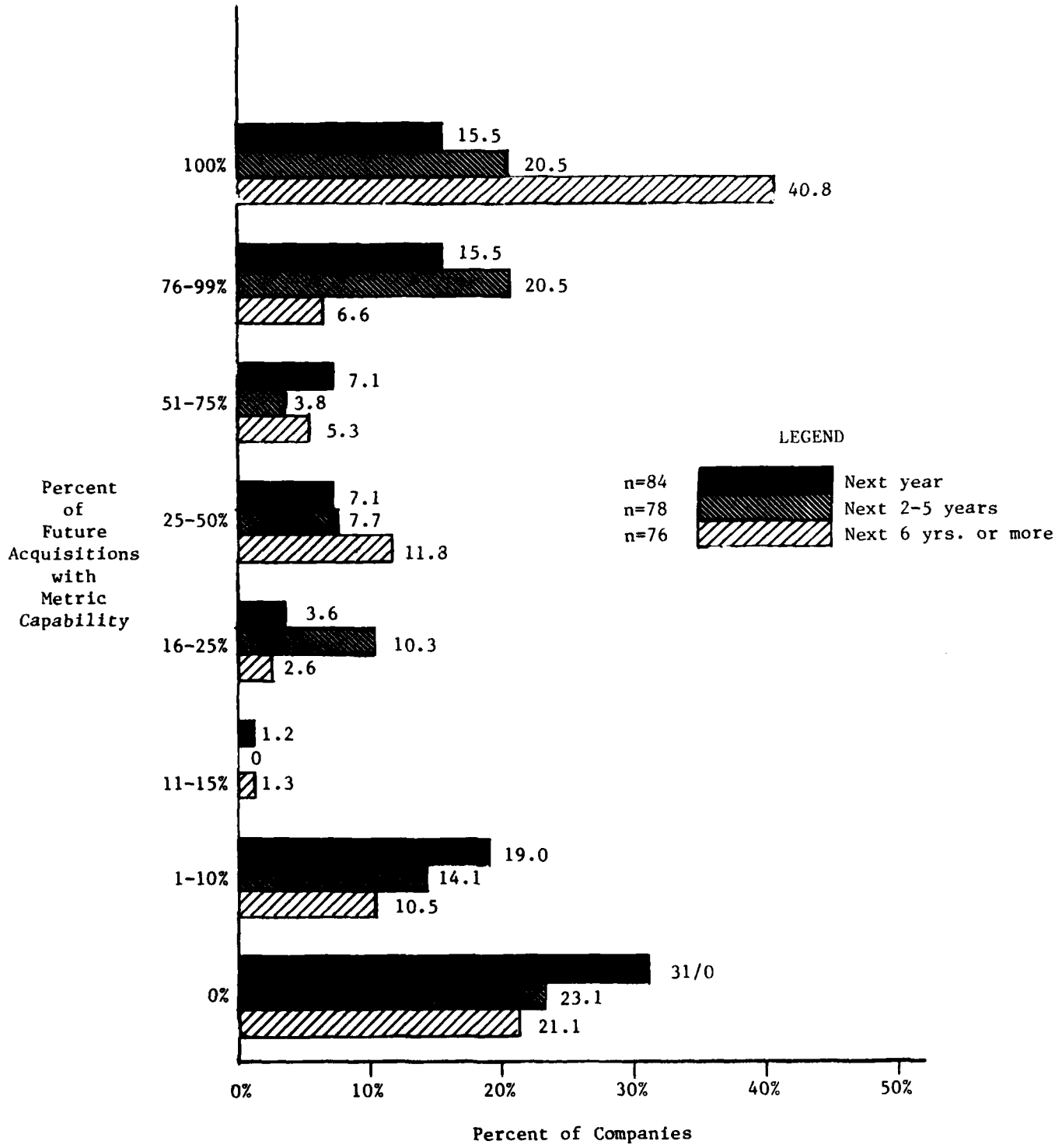
b. Percentage of companies saying that all new products are designed in the indicated type.

c. GAO percentages derived from a question for which a single response was requested for type of drawings primarily used. Number of respondents was 374. Possibly responses were "In customary units" (assumed equivalent to "Non-Metric"), "In dual dimensions" (assumed equivalent to "Soft Metric"), "In Metric Units" (assumed equivalent to "Hard Metric"), and "Separate drawings in customary and in metric units" (assumed equivalent to "Hybrid Metric").

SOURCE of Current Survey: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

SOURCE of GAO DATA: GAO Report, CED-78-128, October 20, 1978.

Figure 5.1. Percent of Companies Estimating Future Acquisitions of equipment with Metric Capability Over Time



SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

Thirty-one percent of the respondents estimated that zero percent of the next year's acquisitions of equipment will have metric capability. The percentage of companies estimating no future acquisitions with metric capability decreases somewhat over the time periods specified to 23 percent over the next 2 to 5 years, and further to 21 percent in the next 6 years or more. Assuming the estimates as to future acquisitions are based on the current rate of voluntary metric conversion in the U.S. (compatible to assumptions for estimating realistic time frames), the following observations can be made.

Approximately 14 percent of the responding companies report that full metrication will occur in 5 years or less. Reporting for the same time period, 20 percent of the companies responding estimate future acquisitions with 100 percent metric production capability.

The percentage of companies (21 percent) who estimate no future acquisitions with metric capability six or more years in the future comes close to the percentage of companies (27 percent) who realistically anticipate that they will never go metric. Comparisons between the Fortune 500 and second 500 (see Table 5.7) show that consistently over time more Fortune 500 companies estimate that 100 percent of their future acquisitions will have metric capability.

The same pattern emerges for both groups whereby over time the percent of companies with no future acquisition with metric capabilities decreases as the percent of companies with 100 percent of future acquisitions having metric capability increases. Ultimately, nearly half of the Fortune 500 compared to one-third of the second 500, expect 100 percent of acquired manufacturing equipment and facilities to have metric production capability. At that time, one-third of the second 500, compared to only about one-eighth of the Fortune 500, will still have acquired no metric capability equipment.

TABLE 5.7. PERCENT OF COMPANIES ESTIMATING FUTURE ACQUISITIONS WITH METIC CAPABILITY OVER TIME

Acquisitions	Top 500			2nd 500		
	Next Year	2-5 Yrs.	6 or More Yrs.	Next Year	2-5 Yrs.	6 or More Yrs.
0%	17	14	12	49	34	33
1-99%	66	65	42	38	46	33
100%	17	21	46	14	20	33
Number of Respondents	47	43	43	37	35	33

NOTE: Sum may not total 100 percent because of rounding.

SOURCE: King Research, Inc., U.S. Metric Board Survey of Selected Large U.S. Firms and Industries, 1980.

SECTION 6
CONCLUSIONS

This study represents the first attempt by the U.S. Metric Board to assess the status of metric conversion among large U.S. industrial firms. Status is examined in terms of sales of metric products and the extent of metric planning and coordination activities. Related factors examined include attitudes toward conversion, perceived impediments to metrication, and estimated time frames for conversion.

Conclusions derived from the analysis of the survey data are:

1. Status of Conversion (sales):
   Overall, 32 percent of present sales of the largest U.S. firms are of metric products (21 percent soft, five percent hybrid and six percent hard). Sixty-three percent (70 of 112 responding) of the large industrial firms produce some metric products; of the firms reporting metric production, 74 percent (52 firms) indicated they were producing soft converted products.

2. Status of Conversion (planning and coordination):
   Limited planning and coordination activity is evident, not only within individual firms, but also among the industry groups surveyed. Comparisons with GAO data (2) show that four of nine comparable internal planning and coordinating activities reflect increases over a three year period, that is, a higher percentage of firms are engaging in the activities now; two of the four increases are eight or more percentage points. For three of the activities a decrease is found; for the remaining two, no change is perceived.

3. Attitudes toward conversion: The prevailing disposition is a "wait and see" attitude. Suppliers wait for customers to demand metric products; customers, in turn, wait for suppliers to make the first move. Coordination on metric matters between suppliers and customers, at both the individual firm and industry-wide levels, appears limited.

4. Impediments to conversion: Impediments (whether real or imaginary, legal and non-legal) continue to hinder, if not discourage, some industries, affecting both the pace and degree of metrication. About half the responding firms singled out customer demand as an important factor inhibiting conversion. About one-third of the respondents identified some form of legal impediment. The non-mandatory process of metrication is found by several firms (11 or about eight percent) to be restrictive.

5. Reasons for converting: The most frequently mentioned reason for conversion is meeting international standards or because the metric system is internationally accepted. Meeting customer demands was the next most frequently mentioned reason for conversion.

6. Time frames for conversion: The median time frames, under a variety of assumptions, for all industrial groups combined, are no more than ten years. There is evidence that metrication may never be fully implemented over all industries.

As a result of the analysis of the responses, the matter of planning and coordination has been identified as an issue for further study. An anomaly seems to exist: considerable evidence of metrication (albeit soft conversion) coupled with very limited planning and coordination. Reasons for the anomaly may be:

- formal coordination and planning activities differ for individual firms as well as industries;

- corporations may view "planning and coordination" to not include the various decision processes that actually are used by the corporation to implement metrication;

- firms may be reluctant to discuss coordination and planning activities;

- planning and coordination activities are discrete entities and may not be necessary for the types of conversion presently dominating the industry groups.

Another consideration is the way we tend to view planning and coordination as an integrated process. It may well be that the functions of investigating, planning, coordinating and implementing should be more carefully assessed as components of a larger process.

APPENDIX A

DESCRIPTION OF SURVEY PLAN

DESCRIPTION OF SURVEY PLAN

The sampling universe for this study was defined as the Fortune listing of the top 1000 U.S. industrial firms (3,4). This listing is organized by total sales, including service and rental revenues; all companies listed must have derived more than half of their sales from manufacturing and/or mining. Excluded from sales are dividends, interest, and other non-operating revenues as well as excise taxes collected (such as those levied on gasoline, liquor, and tobacco).

All firms listed are further classified by a two-digit industry code, based on categories established by the U.S. Office of Management and Budget (OMB). Care must be taken, however, in comparing the Fortune codes within the Standard Industrial Classifiction (SIC) codes of the OMB. While certain two-digit codes match in the two systems, all do not. The Fortune system is designed to encompass all manufacturing and mining business listed in the SIC system. The SIC system also incorporates services, agriculture, construction and trade, not covered by the Fortune code system.

The statistical design is a two-way stratification with size being one stratification factor and the nature of the industry being the second. The Fortune 1000 listing incorporates 28 two-digit codes. These were grouped into five classes which serve as the second stratification factor. Then n_{ij}, where i is the stratification grouping of the top 500 or the second 500, and j is the industry grouping, was selected in proportion to the distribution in the population with individual sampled units chosen by simple random sample within each two way stratum. The sample arrangement follows:

Industry Group

	(1)	(2)	(3)	(4)	(5)
1-500	n_{11}	n_{12}	n_{13}	n_{14}	n_{15}
501-1000	n_{21}	n_{22}	n_{23}	n_{24}	n_{25}

The five classes are shown below along with specific industries included and their respective Fortune industry codes:

Transportation: Shipbuilding, railroad and transportation equipment (37); motor vehicles (40)

Consumer Products: Food (20); tobacco (21); textiles, vinyl flooring (22); apparel (23); furniture (25); leather (31); pharmaceuticals (42); soaps, cosmetics (43); jewelry, silverware (46); beverages (49).

Manufacturing and Production: Mining, crude oil production (10); paper fiber and wood products (26); publishing, printing (27); chemicals (28); petroleum refining (29); rubber, plastic products (30); glass, concrete, abrasives, gypsum (32); metal manufacturing (33); metal products (34); industrial and farm equipment (45).

Aerospace and Electronics: Electronics, appliances (36); measuring, scientific, photographic equipment (38); aerospace (41); office equipment (includes computers) (44)

Entertainment: Musical instruments, toys, sporting goods (47); broadcasting, motion picture production and distribution (48).

Of the top 500, 28 corporations fall into the area of Transportation; 131 into Consumer Products; 254 into Manufacturing and Production; 78 into Aerospace and Electronics; and 9 into Entertainment. In the second 500, Transportation covers 24 corporations; Consumer Products, 129; Manufacturing and Production, 259; Aerospace and Electronics; 73; and Entertainment, 15. The number of corporations, by Fortune code and 500 sector, are summarized in Table A.1.

The corporations in each industry group were listed for the two size groups. Each firm was given an identification number and, with the use of a Random Numbers Table, firms were sampled in proportion to the population. The final sample is shown below.

	Top 500	2nd 500	Total
Transportation	6	5	11
Consumer Products	26	26	52
Manufacturing and Production	51	52	103
Aerospace and Electronics	16	15	31
Entertainment	2	3	5
Total	101	101	202

TABLE A.1. DISTRIBUTION OF THE FORTUNE 1000 U.S. INDUSTRIALS BY STRATA

SIC Industry Code	Number of Corporations			Percent of Population		
	Top 500	2nd 500	Total	Top 500	2nd 500	Total
Transportation:						
37	8	10	18	2%	2%	2%
40	20	14	34	4	3	3
Total	28	24	52	6	5	5
Consumer Products:						
20	62	40	102	12%	8%	10%
21	5	4	9	1	1	1
22	15	21	36	3	4	4
23	10	19	29	2	4	3
25	2	10	12	*	2	1
31	1	4	5	*	1	1
42	17	5	22	3	1	2
43	8	8	16	2	2	2
46	0	5	5	0	1	1
49	11	13	24	2	3	2
Total	131	129	260	26	26	26
Manufacturing & Production:						
10	10	19	29	2%	4%	3%
26	30	22	52	6	4	5
27	11	29	40	2	6	4
28	39	22	61	8	4	6
29	34	10	44	7	2	4
30	7	13	20	1	3	2
32	16	20	36	3	4	4
33	38	29	67	8	6	7
34	21	47	68	4	9	7
45	48	48	96	10	10	10
Total	254	259	513	51	52	51
Aerospace & Electronics:						
36	37	36	73	7%	7%	7%
38	16	20	36	3	4	4
41	14	2	16	3	*	2
44	11	15	26	2	3	3
Total	78	73	151	16	15	15
Entertainment:						
47	4	8	12	1%	2%	1%
48	5	7	12	1	1	1
Total	9	15	24	2	3	2

* Less than one-half of one percent.
SOURCE: King Research, Inc.

APPENDIX B

1979 SURVEY OF SELECTED LARGE U.S. FIRMS AND INDUSTRIES

QUESTIONNAIRE

U.S. Metric Board
1979 Survey of U.S. Industries
OMB #62-S-79001 Expires: Feb. 1, 1980
Due Date: Dec. 14, 1979

The U.S. Metric Board is interested in assessing U.S. corporations' current progress and activities in their voluntary conversion to the metric system. This survey is authorized by the Metric Conversion Act of 1975, PL 94-168, 15USC205a. Your participation is voluntary. This survey is intended to elicit from you information covering your company's current status, progress, and projections with respect to voluntary metric conversion. The purpose of this information is to meet our obligation of coordinating the increasing voluntary use of the metric system and to report to the Congress our national, voluntary metrication progress.

1. Please indicate the current status of each of the following metric conversion activities in your company. Also, for each activity "In process" or "Completed," please indicate the year in which the activity started and the expected or actual completion date.

ACTIVITIES:	No Plans For	Under Consideration	Plans For	In Process	Completed	Not Applicable	Don't Know	Year Started	Expected/ or Actual Completion Year	If Ongoing Check Here	Comments
Issue Metric Policy Statement											
Appoint Metric Coordinator											
Organize Metric Committee											
Develop Company Metrication Plan											
Develop Timetable for Company Conversion											
Conduct Customer Surveys											
Conduct Supplier Surveys											
Analyze Cost of Metrication											
Budget Funds for Metric Conversion Activities											
Train Employees											
Inform Consumers, Customers											
Coordinate with Industry											
Coordinate with Government											
Convert Data Processing and Related Business Systems											
Develop Metric Design and Engineering Standards											
Purchase Materials and Supplies in Metric											
Conduct R&D Activities in Metric Language											
Conduct Process and Production Engineering in Metric Language											

2. Approximately what were your company's 1978 net sales within the U.S.?

$	Millions

3. Approximately what were your company's 1978 net sales outside the U.S.?

$	Millions

4. In the grid on the following page, please list your company's major product groups, their respective 1978 U.S. and Non-U.S. Net Sales and the percent of each which is currently soft converted, hybrid or fully metric. Please be as specific as possible. Major product groups may or may not be related to Standard Industrial Classification codes; if you wish to use SIC codes for product groups, you can find them in the Standard Industrial Classification Manual published by the U.S. Office of Management and Budget.

   For the purpose of this study:

   Soft conversion is the expression of inch-pound units of measure in their direct metric equivalent; there is no physical change in the product itself. Soft converted products are products that are described/specified in metric or dual units, either by the customer (e.g., 1/2 inch tube ordered as 12.7 mm tube) or by the manufacturer (on drawings, mfg process, engineering standards, etc.).

   Fully metric product is a product that has been designed and/or manufactured using metric as the only or the preferred system of units (regardless whether "soft" or "hard").

   Hybrid metric products are composed of both metric and non-metric parts, components, and/or materials.

Product Group	1978 U.S. Net Sales ($Thousands)	% of Sales			1978 Non-U.S. Net Sales ($Thousands)	% of Sales		
		Soft Conv. Prod.	Hybrid Prod.	Fully Metric Prod.		Soft Conv. Prod.	Hybrid Prod.	Fully Metric Prod.

5A. What percent of your company's new products are being designed as:

Non-Metric Products	_____ %
Soft Converted Metric Products	_____ %
Fully Metric Products	_____ %
Hybrid Metric Products	_____ %

5B. If you designed and/or manufactured a new product as fully metric or hybrid metric, were the costs related to this new product greater than, equal to or less than those if this product had been non-metric?

	Design Costs	Manufacturing Costs Over Production Life
Much greater	☐	☐
Somewhat greater	☐	☐
About the same	☐	☐
Somewhat lower	☐	☐
Much lower	☐	☐
Not applicable	☐	☐

6A. Assume no significant change in the current rate of the voluntary metrication progress in the U.S. In approximately how many years (realistically) will your company be metric?

☐ years

6B. Assume that extreme pressure to voluntarily metricate would be exerted on your company (e.g., by customers, suppliers, environment, etc.). What is the minimum number of years in which your company could metricate based on the measurement sensitivity of your products and/or operations?

☐ years

6C. When would your company prefer to be metric?

☐ years

7A. What percent of your current manufacturing equipment has metric production, processing and/or operating capability? (Include any facilities such as refineries, power plants, etc.)

[ ] %

7B. What percent of your future acquisitions of equipment and facility will have metric production, processing and/or operating capability?

Next Yr.	Next 2-5 Yrs.	Next 6 Yrs. or More
[ ] %	[ ] %	[ ] %

8A. Which of the following laws or regulations, if any, currently inhibit conversion by your company to the metric system? (Check all that apply.)

- [ ] U.S. Federal or State Procurement Regulations
- [ ] Building Codes
- [ ] State and Local Laws
- [ ] U.S. Federal Antitrust Laws
- [ ] Other U.S. Federal Laws or Regulations
- [ ] (Specify)_____
- [ ] None
- [ ] Don't Know

8B. Other than legal or regulatory barriers, what factors currently inhibit metric conversion for your company?

9. If your company has begun metrication:

a. What were the reasons for metrication?

b. What benefits, if any, did you derive?

c. What would you do differently if you were to start metricating today?

Thank you for your help with this study. If you have any other comments, please use the space below.

Please return this questionnaire in the envelope provided.

APPENDIX C

DATA TABLES

Table of Contents

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT)

Base Number of Respondents	Total[a] 130	Top 500 71	2nd 500 59	Transportation 7	Consumer Products 36	Manufacturing & Production 68	Aerospace & Electronics 17
Metric Activity							
Issue Metric Policy Statement							
No Plans For	59.8	44.8	78.2	28.6	70.6	61.5	35.7
Under Consideration	13.1	14.9	10.9	28.6	14.7	10.8	14.3
Plans For	2.5	3.0	1.8	0	0	1.5	14.3
In Process	4.1	4.5	3.6	0	8.8	3.1	0
Completed	20.5	32.8	5.5	42.9	5.9	23.1	35.7
Total number of respondents[b]	122	67	55	7	34	65	14
Not applicable[c]	3.1	2.8	3.4	0	5.6	2.9	0
Don't know/No response	3.1	2.8	3.4	0	0	1.5	17.6
Appoint Metric Coordinator							
No Plans For	57.3	42.6	75.0	28.6	64.7	59.1	40.0
Under Consideration	8.1	8.8	7.1	0	11.8	6.1	13.3
Plans For	1.6	0	3.6	0	0	1.5	6.7
In Process	2.4	2.9	1.8	14.3	2.9	1.5	0
Completed	30.6	45.6	12.5	57.1	20.6	31.8	40.0
Total number of respondents[b]	124	68	56	7	34	66	15
Not applicable[c]	2.3	1.4	3.4	0	2.8	2.9	0
Don't know/No response	2.3	2.8	1.7	0	2.8	0	11.8
Organize Metric Committee							
No Plans For	65.8	53.8	80.0	28.6	77.4	69.2	40.0
Under Consideration	6.7	7.7	5.5	0	12.9	4.6	6.7
Plans For	4.2	4.6	3.6	14.3	0	3.1	13.3
In Process	1.7	1.5	1.8	0	3.2	1.5	0
Completed	21.7	32.3	9.1	57.1	6.5	21.5	40.0
Total number of respondents[b]	120	65	55	7	31	65	15
Not applicable[c]	5.4	5.6	5.1	0	13.9	2.9	0
Don't know/No response	2.3	2.8	1.7	0	0	1.5	11.8

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT')

Metric Activty	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Develop Company Metrication Plan							
No Plans For	63.9	52.2	78.2	28.6	64.7	70.8	42.9
Under Consideration	13.1	16.4	9.1	14.3	17.6	9.2	21.4
Plans For	2.5	3.0	1.8	0	0	4.6	0
In Process	9.0	11.9	5.5	14.3	8.8	9.2	7.1
Completed	11.5	16.4	5.5	42.9	8.8	6.2	28.6
Total number of respondents[b]	122	67	55	7	34	65	14
Not applicable[c]	3.1	2.8	3.4	0	5.6	1.5	5.9
Don't know/No response	3.1	2.8	3.4	0	0	2.9	11.8
Develop Timetable for Company Conversion							
No Plans For	71.2	60.3	83.6	42.9	75.0	74.6	57.1
Under Consideration	8.5	9.5	7.3	0	9.4	9.5	7.1
Plans For	5.1	6.3	3.6	14.3	0	4.8	14.3
In Process	8.5	12.7	3.6	14.3	6.3	9.5	7.1
Completed	6.8	11.1	1.8	28.6	9.4	1.6	14.3
Total number of respondents[b]	118	63	55	7	32	63	14
Not applicable[c]	3.8	4.2	3.9	0	5.6	2.9	5.9
Don't know/No response	5.4	7.0	3.9	0	5.6	4.4	11.8
Conduct Customer Surveys							
No Plans For	78.1	67.2	90.6	85.7	73.3	79.0	76.9
Under Consideration	7.0	9.8	3.8	0	13.3	4.8	7.7
Plans For	0	0	0	0	0	0	0
In Process	11.3	19.7	1.9	14.3	6.7	12.9	15.4
Completed	3.5	3.3	3.8	0	6.7	3.2	0
Total number of respondents[b]	114	61	53	7	30	62	13
Not applicable[c]	9.2	11.3	6.8	0	16.7	5.9	11.8
Don't know/No response	3.1	2.9	3.4	0	0	2.9	11.8

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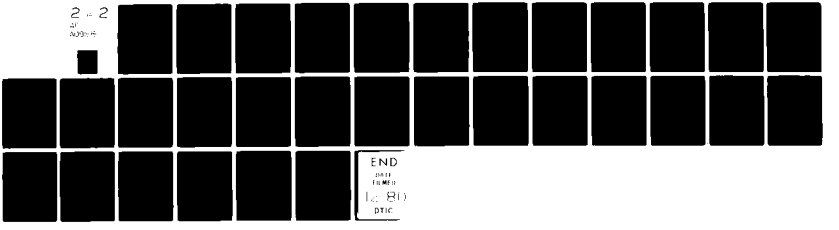

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TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT'D)

Metric Activity	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Conduct Supplier Surveys							
No Plans For	73.9	58.2	94.2	57.1	75.0	82.3	43.8
Under Consideration	5.0	7.5	1.9	14.3	9.4	1.6	6.3
Plans For	0.8	1.5	0	0	0	0	6.3
In Process	15.1	25.4	1.9	14.3	12.5	12.9	31.3
Completed	5.0	7.5	1.9	14.3	3.1	3.2	12.5
Total number of respondents[a]	119	67	52	7	32	62	16
Not applicable[b]	5.4	2.8	8.5	0	11.1	4.4	0
Don't know/No Response	3.1	2.8	3.4	0	0	4.4	5.9
Analyze Cost of Metrication							
No Plans For	70.5	60.0	82.5	71.4	70.6	74.6	50.0
Under Consideration	11.5	12.3	10.5	28.6	17.6	6.3	12.5
Plans For	0.8	1.5	0	0	0	0	6.3
In Process	8.2	13.8	1.8	0	2.9	9.5	18.8
Completed	9.0	12.3	5.3	0	8.8	9.5	12.5
Total number of respondents[a]	122	65	57	7	34	63	16
Not applicable[b]	3.8	4.2	3.4	0	5.6	4.4	0
Don't know/No Response	2.3	4.2	0	0	0	2.9	5.9
Budget Funds for Metric Conversion Activities							
No Plans For	81.7	76.2	87.7	66.7	84.8	84.4	66.7
Under Consideration	3.3	4.8	1.8	16.7	0	4.7	0
Plans For	4.2	4.8	3.5	16.7	3.0	1.6	13.3
In Process	5.0	7.9	1.8	0	3.0	6.3	6.7
Completed	5.8	6.3	5.3	0	9.1	3.1	13.3
Total number of respondents[a]	120	63	57	6	33	64	15
Not applicable[b]	4.6	5.6	3.4	0	8.3	2.9	5.9
Don't know/No response	3.1	5.6	0	14.3	0	2.9	5.9

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT'D)

Metric Activity	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Train Employees							
No Plans For	65.6	47.8	87.3	57.1	67.6	73.0	31.3
Under Consideration	4.1	6.0	1.8	0	2.9	4.8	6.3
Plans For	5.7	7.5	3.6	14.3	2.9	4.8	12.5
In Process	23.8	37.3	7.3	28.6	23.5	17.5	50.0
Completed	0.8	1.5	0	0	2.9	0	0
Total number of respondents[b]	122	67	55	7	34	63	16
Not applicable[c]	3.8	1.4	6.8	0	5.6	4.4	0
Don't know/No response	2.3	4.2	0	0	0	2.9	5.9
Inform Consumers, Customers							
No Plans For	74.4	61.9	88.9	85.7	78.1	73.0	61.5
Under Consideration	4.3	6.3	1.9	0	3.1	4.8	7.7
Plans For	4.3	7.9	0	14.3	3.1	4.8	0
In Process	13.7	20.6	5.6	0	9.4	17.5	15.4
Completed	3.4	3.2	3.7	0	6.3	0	15.4
Total number of respondents[b]	117	63	54	7	32	63	13
Not applicable[c]	6.9	8.5	5.1	0	11.1	4.4	11.8
Don't know/No response	3.1	2.8	3.4	0	0	2.9	11.8
Coordinate With Industry							
No Plans For	50.0	34.8	69.1	42.9	47.1	53.0	40.0
Under Consideration	8.1	10.1	5.5	0	8.8	9.1	6.7
Plans For	5.6	5.8	5.5	14.3	5.9	4.5	6.7
In Process	30.6	42.0	16.4	28.6	29.4	28.8	46.7
Completed	5.6	7.2	3.6	14.3	8.8	4.5	0
Total number of respondents[b]	124	69	55	7	34	66	15
Not applicable[c]	3.1	1.4	5.1	0	5.6	2.9	0
Don't know/No response	1.5	1.4	1.7	0	0	0	11.8

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT'D)

Metric Activity	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Coordinate With Government							
No Plans For	62.7	51.5	76.9	57.1	63.3	61.5	64.3
Under Consideration	9.3	12.1	5.8	14.3	13.3	7.7	7.1
Plans For	5.1	4.5	5.8	0	3.3	6.2	7.1
In Process	20.3	28.8	9.6	14.3	16.7	23.1	21.4
Completed	2.5	3.0	1.9	14.3	3.3	1.5	0
Total number of respondents[b]	118	66	52	7	30	65	14
Not applicable[c]	4.6	4.2	5.1	0	11.1	1.5	5.9
Don't know/No response	4.6	2.8	6.8	0	5.6	2.9	11.8
Convert DP and Relatd Bus. System							
No Plans For	70.4	55.6	88.5	66.7	71.0	70.5	66.7
Under Consideration	7.8	11.1	3.8	16.7	9.7	8.2	0
Plans For	1.7	1.6	1.9	0	0	1.6	6.7
In Process	18.3	28.6	5.8	16.7	16.1	18.0	26.7
Completed	1.7	3.2	0	0	3.2	1.6	0
Total number of respondents[b]	115	63	52	6	31	61	15
Not applicable[c]	6.9	5.6	8.5	0	8.3	7.4	5.9
Dont' know/No response	4.6	5.6	3.4	14.3	5.6	2.9	5.9
Dev. Metric Design & Engr. Standards							
No Plans For	57.9	46.2	71.4	28.6	63.6	63.5	31.3
Under Consideration	12.4	16.9	7.1	14.3	12.1	12.7	12.5
Plans For	1.7	0	3.6	0	3.0	1.6	0
In Process	24.8	33.8	14.3	42.9	18.2	20.6	50.0
Completed	3.3	3.1	3.6	14.3	3.0	1.6	6.3
Total number of respondents[b]	121	65	56	7	33	63	16
Not applicable[c]	5.4	5.6	5.1	0	8.3	5.9	0
Don't know/No response	1.5	2.8	0	0	0	1.5	5.9

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT'D)

Metric Activity	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Purchase Mat. & Suppl. in Metric							
No Plans For	62.2	50.0	77.4	57.1	48.6	76.7	33.3
Under Consideration	7.6	10.6	3.8	14.3	2.9	6.7	20.0
Plans For	3.4	3.0	3.8	0	8.6	0	6.7
In Process	22.7	33.3	9.4	14.3	31.4	15.0	40.0
Completed	4.2	3.0	5.7	14.3	8.6	1.7	0
Total number of respondents[b]	119	66	53	7	35	60	15
Not applicable[c]	4.6	1.4	8.5	0	2.8	5.9	5.9
Don't know/No respnse	3.8	5.6	1.7	0	0	5.9	5.9
Conduct R&D Activities in Metric Language							
No Plans For	54.6	41.5	70.4	42.9	50.0	62.9	31.3
Under Consideration	7.6	9.2	5.6	28.6	6.3	3.2	18.8
Plans For	3.4	1.5	5.6	0	3.1	3.2	6.3
In Process	30.3	43.1	14.8	28.6	31.3	27.4	43.8
Completed	4.2	4.6	3.7	0	9.4	3.2	0
Total number of respondents[b]	119	65	54	7	32	62	16
Not applicable[c]	2.3	0	5.1	0	5.6	1.5	0
Don't know/No response	6.2	8.5	3.4	0	5.6	7.4	5.9

TABLE 1. STATUS OF METRIC CONVERSION ACTIVITIES (PERCENT) (CONT'D)

Metric Activity	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Conduct Process & Production Engineering in Metric Language							
No Plans For	66.4	59.1	75.0	28.6	63.6	75.0	50.0
Under Consideration	9.0	9.1	8.9	57.1	6.1	6.3	6.3
Plans For	3.3	3.0	3.6	0	6.1	1.6	6.3
In Process	18.9	28.8	7.1	14.3	15.2	17.2	37.5
Completed	2.5	0	5.4	0	9.1	0	0
Total number of respondents[b]	122	66	56	7	33	64	16
Not applicable[c]	3.1	2.8	3.4	0	5.6	2.9	0
Don't know/No response	3.1	4.2	1.7	0	2.8	2.9	5.9

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data not included in totals.

[b]Percentages of companies responding "no plans for," "under consideration," "plans for," "in process," or "completed" are calculated from respondents excluding "Not applicable," "Don't know," and no response.

[c]Percentages of companies responding "Not applicable" or "Don't know" and nonrespondents are calculated from total number of respondents.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROCESS OR COMPLETED (PERCENT)

	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
Metric Activity	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Issue Metric Policy Statement														
1970 & Earlier	4.8	0	0	0	33.3	0	0	0	0	0	0	0	25.0	0
1971-1975	38.1	17.6	44.4	18.8	0	0	100.0	66.7	0	0	36.4	12.5	25.0	0
1976-1979	57.1	76.5	55.6	75.0	66.7	100.0	0.0	33.3	100.0	100.0	63.6	87.5	50.0	75.0
1980-1985	0	5.9	0	6.3	0	0	0	0	0	0	0	0	0	25.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	1.3(11)													
No. of Respondents[c]	21	17	18	16	3	1	3	3	3	2	11	8	4	4
Appoint Metric Coordinator														
1970 & Earlier	3.1	9.5	0	5.9	20.0	25.0	0	0	0	0	6.3	12.5	0	25.0
1971-1975	50.0	38.1	51.9	41.2	40.0	25.0	60.0	50.0	0	0	50.0	50.0	100.0	50.0
1976-1979	46.9	52.4	48.1	52.9	40.0	50.0	40.0	50.0	100.0	100.0	43.8	37.5	0	25.0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	0.6(16)													
No. of Respondents[c]	32	21	27	17	5	4	5	4	6	5	15	8	5	4
Organize Metric Committee														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	62.5	50.0	64.3	54.5	50.0	0	75.0	66.7	0	0	62.5	50.0	66.7	50.0
1976-1979	37.5	50.0	35.7	45.5	50.0	100.0	25.0	33.3	100.0	100.0	37.5	50.0	33.3	50.0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Year[b]	1.3(8)													
No. of Respondents[c]	16	12	14	11	2	1	4	3	1	1	8	6	3	2

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROGRESS OR COMPLETED (PERCENT) (CONT'D)

Metric Activity	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Develop Co. Metrication Plan														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	41.2	25.0	50.0	30.0	0	0	66.7	66.7	0	0	50.0	0	50.0	33.3
1976-1979	58.8	50.0	50.0	50.0	100.0	50.0	33.3	0	100.0	66.7	50.0	100.0	50.0	33.3
1980-1985	0	25.0	0	20.0	0	50.0	0	33.3	0	33.3	0	0	0	33.3
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	3.1(9)													
No. of Respondents[c]	17	12	14	10	3	2	3	3	4	3	6	3	4	3
Develop Timetable for Co. Conversion														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	36.4	33.3	44.4	50.0	0	0	50.0	50.0	0	0	40.0	0	50.0	50.0
1976-1979	63.6	50.0	55.6	50.0	100.0	50.0	50.0	0	100.0	100.0	60.0	0	50	50.0
1980-1985	0	16.7	0	0	0	50.0	0	50.0	0	0	0	0	0	0
1986 & Later	0	0	0		0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	0.9(5)													
No. of Respondents[c]	11	6	9	4	2	2	2	2	2	2	5	0	2	2
Conduct Customer Surveys														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	14.3	0	16.7	0	0	0	0	0	0	0	20.0	0	0	0
1976-1979	85.7	100.0	83.3	100.0	100.0	100.0	0	0	100.0	100.0	80.0	100.0	0	0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Means No. of Years[b]	1.0(2)													
No. of Respondents[c]	7	2	6	1	1	1	0	0	2	1	5	1	0	0

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROGRESS OR COMPLETED (PERCENT) (CONT'D)

	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
Metric Activity	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Conduct Supplier Surveys														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	16.7	25.0	18.2	25.0	0	0	100.0	0	0	0	20.0	0	0	50.0
1976-1979	83.3	50.0	81.8	50.0	100.0	0	0	100.0	100.0	0	80.0	100.0	100.0	0
1980-1985	0	25.0	0	25.0	0	0	0	0	0	0	0	0	0	50.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	3.7(3)													
No. of Respondents[c]	12	4	11	4	1	0	1	1	3	0	5	1	3	2
Analyze Cost of Metrication														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	42.9	33.3	41.7	40.0	50.0	0	0	0	0	0	42.9	0	75.0	66.7
1976-1979	57.1	50.0	58.3	40.0	50.0	100.0	0	0	100.0	100.0	57.1	100.0	25.0	0
1980-1985	0	16.7	0	20.0	0	0	0	0	0	0	0	0	0	33.3
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	2.6(5)													
No. of Respondents[c]	14	5	12	5	2	1	0	0	3	1	7	2	4	3
Budget Funds for Metric Conv. Activities														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976-1979	85.7	50.0	83.3	33.3	100.0	100.0	0	0	100.0	50.0	66.7	0	100.0	100.0
1980-1985	14.3	50.0	16.7	66.7	0	0	0	0	0	50.0	33.3	100.0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	1.3(4)													
No. of Respondents[c]	7	4	6	3	1	1	0	0	3	2	3	1	1	1

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROGRESS OR COMPLETED (PERCENT) (CONT'D)

Metric Activity	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Train Employees														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	28.6	0	33.3	0	0	0	0	0	40.0	0	20.0	0	25.0	0
1976-1979	71.4	0	66.7	0	100.0	0	0	0	60.0	0	80.0	0	75.0	0
1980-1985	0	100.0	0	100.0	0	0	0	0	0	0	0	0	0	100.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	8.5(2)													
No. of Respondents[c]	14	2	12	2	2	0	0	0	5	0	5	0	4	2
Inform Consumers, Customers														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976-1979	100.0	100.0	100.0	0	100.0	100.0	0	0	100.0	100.0	100.0	0	100.0	0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	1(1)													
No. of Respondents[c]	10	1	7	0	3	1	0	0	3	1	5	0	2	0
Coordinate with Industry														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	34.8	0	36.8	0	25.0	0	100.0	0	25.0	0	27.3	0	50.0	0
1976-1979	65.2	75.0	63.2	66.7	75.0	100.0	0	0	75.0	100.0	72.7	0	50.0	0
1980-1985	0	25.0	0	33.3	0	0	0	0	0	0	0	100.0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	2(4)													
No. of Respondents[c]	23	4	19	3	4	1	2	0	8	3	11	1	2	0

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROCESS OR COMPLETED (PERCENT) (CONT'D)

Metric Activity	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Coordinate with Government														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	30.0	0	30.0	0	0	0	100.0	0	0	0	20.0	0	100.0	0
1976-1979	70.0	0	70.0	0	0	0	0	0	100.0	0	80.0	0	0	0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	0													
No. of Respondents[c]	10	0	10	0	0	0	1	0	3	0	5	0	1	0
Convert DP & Related Bus. System														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	16.7	0	18.2	0	0	0	0	0	0	0	16.7	0	50.0	0
1976-1979	83.3	14.3	81.8	16.7	100.0	0	100.0	0	100.0	50.0	83.3	0	50.0	0
1980-1985	0	85.7	0	83.7	0	100.0	0	100.0	0	50.0	0	100.0	0	100.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	4.6(5)													
No. of Respondents[c]	12	7	11	6	1	1	1	1	3	2	6	2	2	2
Develop Metric Design & Engr. Standards														
1970 & Earlier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971-1975	35.3	0	54.5	0	0	0	0	0	60.0	0	33.3	0	20.0	0
1976-1979	64.7	16.7	45.5	0	100.0	33.3	100.0	0	40.0	50.0	66.7	0	80.0	0
1980-1985	0	83.3	0	100.0	0	66.7	0	100.0	0	50.0	0	100.0	0	100.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	4.6(5)													
No. of Respondents[c]	17	6	11	3	6	3	1	1	5	2	6	2	5	1

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROCESS OR COMPLETED (PERCENT) (CONT'D)

Metric Activity	Total[a]		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Purchase Materials & Supplies In Metric														
1970 & Earlier	0	40.0	0	50.0	0	33.3	0	0	0	50.0	0	0	0	0
1971-1975	15.4	0	18.2	0	0	0	0	0	40.0	0	0	0	0	0
1976-1979	84.6	60.0	81.8	50.0	100.0	66.7	0	0	60.0	50.0	100.0	100.0	100.0	0
1980-1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	1(3)													
No. of Respondents[c]	13	5	11	2	2	3	0	0	5	4	5	1	3	0
Conduct R&D Act. in Metric Language														
1970 & Earlier	6.3	66.7	7.1	50.0	0	100.0	0	0	0	100.0	14.3	0	0	0
1971-1975	31.3	0	35.7	0	0	0	0	0	66.7	0	0	0	75.0	0
1976-1979	62.5	0	57.1	0	100.0	0	100.0	0	33.3	0	85.7	0	25.0	0
1980-1985	0	33.3	0	50.0	0	0	0	0	0	0	0	0	0	100.0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[b]	12(1)													
No. of Respondents[c]	16	3	14	2	2	1	2	0	3	5	2	0	4	1

TABLE 2. PROGRESS OF METRIC CONVERSION ACTIVITIES WHICH ARE IN PROCESS OR COMPLETED (PERCENT) (CONT'D)

Metric Activity	Total[a]		Top 500		2nd 500		Transportation		Consumers Products		Manufacturing & Production		Aerospace & Electronics	
	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.	Beg.	Compl.
Conduct Proc. & Prod. Engr. in Metric Language														
1970 & Earlier	0	40.0	0	33.3	0	50.0	0	0	0	66.7	0	0	0	0
1971-1975	12.5	0	14.3	0	0	0	0	0	33.3	0	0	0	0	0
1976-1979	87.5	20.0	85.7	0	100.0	50.0	0	0	66.7	33.3	100.0	0	100.0	100.0
1980-1985	0	40.0	0	66.7	0	0	0	0	0	0	0	100.0	0	0
1986 & Later	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean No. of Years[a]	4.5(2)													
No. of Respondents[b]	8	5	7	3	1	2	0	0	3	3	2	1	3	1

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data not included in totals.

[b]Number of years required to complete activity; number of respondents who gave both beginning and completion dates are in parentheses.

[c]Number of respondents includes companies with activities in process or completed who responded to the year stated (beg.) or the estimated/actual year of completion (compl.).

SOURCE: King Research, Inc., U. S. Metric Board Survey of Large U. S. Firms and Industries, 1980.

TABLE 3. 1978 NET SALES ($ IN MILLIONS) AND METRIC ACTIVITY

	Total		Top 500		2nd 500		Transportation		Consumer Products		Manufacturing & Production		Aerospace & Electronics	
	$ Volume	%	& Volume	%	& Volume	%	& Volume	%	& Volume	%	& Volume	&	% Volume	%
Net US 1978 Sales	88,848	100	80,782	100	7.706	100	5,873	100	13,915	100	59,296	100	4,143	100
Net US Metric Sales	25,707	29.0	24,011	29.7	1,693	22.0	2,249	38.3	9,149	65.7	13,258	22.4	1.049	11.5
Soft Converted Products	17,354	19.6	16,147	20.0	1,207	15.7	235	4.0	5,670	40.7	10,947	18.5	501	5.5
Hybrid Products	4,207	4.7	4,148	5.1	60	.8	1,993	33.9	1,626	11.7	584	1.0	4	.1
Hard Metric Products	4,145	4.7	3,716	4.6	427	5.5	21	.4	1,853	13.3	1,727	2.9	544	5.9
Net Non-US Sales	19,175	100	18,451	100	724	100	1,359	100	1,945	100	12,801	100	3,070	100
Net Non-US Metric Sales	9,171	47.8	8,802	47.7	368	50.8	885	65.1	1,559	80.1	6,189	48.3	537	17.5
Soft Converted Products	5,679	29.6	5,599	30.3	79	10.9	91	6.7	909	46.7	4,162	32.5	517	16.8
Hybrid Metric Products	1,215	6.3	1,210	6.6	5	.7	560	41.2	6	.3	628	4.9	20	.7
Hard Metric Products	2,277	11.9	1,993	10.8	284	39.2	234	17.2	644	33.1	1,399	10.9	0	0
BASE: Total responses to Q 2-4		98		55		43		6		25		55		10

[a]"Entertainment" category is not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 4. NEW PRODUCT METRIC DESIGN (PERCENT)[a]

Base Number of Respondents[b]	Total 130	500 71	500 50	Trans-portation 7	Consumer Products 36	Manufac-turing & Production 68	Aerospace & Electronics 17
New Products Being Designed As:							
Non Metric Products							
0%	24.0	28.6	18.2	14.3	37.0	20.8	15.4
1-10%	2.0	3.6	0	0	3.7	1.9	0
11-15%	0	0	0	0	0	0	0
16-25%	2.0	1.8	2.3	0	3.7	0	7.7
26-50%	6.0	8.9	2.3	14.3	7.4	3.8	7.7
51-75%	3.0	5.4	0	14.3	0	3.8	0
76-99%	18.0	12.5	25.0	28.6	7.4	18.9	30.8
100%	45.0	39.3	52.3	28.6	40.7	50.9	38.5
Mean % of Product	66.4	58.7	76.1	73.1	51.7	71.6	72.0
No. of Respondents	100	56	44	7	27	53	13
Soft Converted Metric Products							
0%	69.7	62.5	79.1	42.9	70.4	73.1	69.2
1-10%	9.1	12.5	4.7	28.6	3.7	5.8	23.1
11-15%	1.0	0	2.3	0	0	1.9	0
16-25%	3.0	3.6	2.3	14.3	3.7	1.9	0
26-50%	3.0	5.4	0	14.3	3.7	1.9	0
51-75%	2.0	3.6	0	0	0	1.9	7.7
76-99%	3.0	3.6	2.3	0	3.7	3.8	0
100%	9.1	8.9	9.3	0	14.8	9.6	0
Mean % of Products	15.6	18.2	12.1	8.7	20.7	16.3	5.5
No of Respondents	99	56	43	7	27	52	13
Hard Metric Products							
0%	69.0	63.2	76.7	85.7	57.1	73.1	69.2
1-10%	12.0	10.5	14.0	0	10.7	11.5	23.1
11-15%	2.0	1.8	2.3	14.3	0	1.9	0
16-25%	4.0	7.0	0	0	3.6	5.8	0
26-50%	3.0	3.5	2.3	0	7.1	1.9	0
51-75%	0	0	0	0	0	0	0
76-99%	3.0	5.3	0	0	3.6	3.8	0
100%	7.0	8.8	4.7	0	17.9	1.9	7.7
Mean % of Products	12.8	17.1	7.9	2.1	26.3	8.1	8.6
No. of Respondents	100	57	43	7	28	52	13
Hybrid Metric Products							
0%	83.3	80.4	88.4	57.1	96.3	82.7	76.9
1-10%	8.1	7.1	9.3	28.6	0	9.6	7.7
10-15%	0	0	0	0	0	0	0
16-25%	3.0	5.4	0	0	0	5.8	0
26-50%	2.0	3.6	0	0	3.7	1.9	0
51-75%	0	0	0	0	0	0	0
76-99%	1.0	1.8	0	0	0	0	7.7
100%	2.0	1.8	2.3	14.3	0	0	7.7
Mean % of Products	4.6	6.1	2.8	16.0	1.1	2.6	13.9
No. of Respondents	99	56	43	7	27	52	13

[a]Percentages exclude missing values, not applicable (no new products) and nonrespondents.

[b]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 5. COST OF METRICATION (PERCENT)

	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Design Costs							
Much greater than non-Metric	6.5	4.5	11.1	0	0	12.5	0
Somewhat greater than non-Metric	32.3	27.3	44.4	0	14.3	31.3	80.0
About the same as non-Metric	61.3	68.2	44.4	100.0	85.7	56.3	20.0
Somewhat lower than non-Metric	0	0	0	0	0	0	0
Much lower than non-Meric	0	0	0	0	0	0	0
No. of Respondents[b]	31	22	9	3	7	16	5
Don't Know/No Answer	18.5	22.5	13.6	0	22.2	14.7	35.3
Not Applicable	57.7	46.5	71.2	57.1	58.3	61.8	35.3
Manufacturing Costs Over Production Life							
Much greater than non-Metric	6.7	0	22.2	0	0	13.3	0
Somewhat greater than non-Metric	20.0	28.6	0	0	0	26.7	40.0
About the same as non-Metric	73.3	71.4	77.8	100.0	100.0	60.0	60.0
Somewhat lower than non-Metric	0	0	0	0	0	0	0
Much lower than non-Metric	0	0	0	0	0	0	0
No. of Respondents[b]	30	21	9	3	7	15	5
Don't Know/No Answer	19.2	23.9	13.6	0	22.2	16.2	35.3
Not Applicable	57.7	46.5	71.2	57.1	58.3	61.8	35.3
Total Possible Respondents	130	71	59	7	36	68	17

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

[b]Number of respondents includes companies who design new products as hybrid and/or hard metric; percentages based on these respondents; don't know, no answer and not applicable excluded.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 6. REALISTIC, MINIMUM AND PREFERABLE TIME FRAMES FOR METRICATION (PERCENT)

	Total	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Realistic Time Frame							
0 to 5 years	17.2	11.1	24.4	0	33.3	13.5	14.3
6 to 10 years	22.2	25.9	17.8	42.9	12.5	21.1	28.6
11 to 15 years	12.1	18.5	4.4	28.6	4.2	11.5	21.4
16 to 20 years	10.0	9.3	11.1	14.3	16.7	7.7	7.1
Over 20 years	12.1	14.8	8.9	14.3	12.5	15.4	0
Never	26.3	20.4	33.3	0	20.8	30.8	28.6
Total respondents	99	54	45	7	24	52	14
Mean no. of years	15.1	15.7	14.2	13.9	17.1	15.8	10.4
Median	10	12	10	12	10	11	10
Mode	10	10	5/10	10	5/20	10	10
Range	0-100	0-75	0-100	0-25	0-100	0-75	0-20
Respondents	73	43	30	7	19	36	10
Minimum Time Frame							
0 to 5 years	78.6	79.7	77.3	85.7	84.6	74.5	84.6
6 to 10 years	11.6	13.5	9.1	14.3	7.7	16.4	0
11 to 15 years	1.0	1.7	0	0	3.8	0	0
16 to 20 years	1.0	0	2.3	0	0	1.8	0
Over 20 years	1.0	1.7	0	0	0	1.8	0
Never	6.8	3.4	11.3	0	3.8	5.5	15.4
Total respondents	103	59	44	7	26	55	13
Mean no. of years	4.2	4.7	3.6	4.6	3.6	4.7	3.7
Median	3	4	2	4	2	3	5
Mode	5	5	1	3/5	2	5	5
Range	0-25	0-25	0-20	0-10	0-15	0-25	0-5
Respondents	96	57	39	7	25	52	11

TABLE 6. REALISTIC, MINIMUM AND PREFERABLE TIME FRAMES FOR METRICATION (PERCENT) (CONT'D)

	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Preferable Time Frame							
0 to 5 years	28.6	27.8	29.4	25.0	36.8	23.5	36.3
6 to 10 years	17.1	22.2	11.8	25.0	10.5	26.5	0
11 to 15 years	8.6	13.9	2.9	25.0	0	8.9	18.2
16 to 20 years	2.9	5.5	0	0	10.5	0	0
Over 20 years	7.1	2.8	11.8	25.0	5.3	8.9	0
Never	35.7	27.8	44.1	0	36.8	32.3	45.5
Total respondents	70	36	34	4	19	34	11
Mean no. of years	11.7	9.4	14.8	13.8	8.8	14.1	6.7
Median	8	9	5	12.5	5	10	3.5
Mode	10	10	5	-	5	10	3/15[b]
Range	0-100	0-25	0-100	5-25	0-30	0-100	0-15
Respondents[c]	45	26	19	4	12	23	6

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentility. Data are included in totals.

[b]Bimodal.

[c]Respondents providing times other than "never"; base for descriptive statistics.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 7. METRIC PRODUCTION, PROCESSING, AND OPERATING CAPABILITY (PERCENT)

Status	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Percent of Current Equipment Having Such Capability							
0	30.2	13.8	50.0	14.3	30.0	30.0	30.8
1-10	26.4	34.5	16.7	14.3	13.3	36.4	23.1
11-15	5.7	8.6	2.1	14.3	6.7	3.6	7.7
16-25	4.7	5.2	4.2	14.3	6.7	1.8	7.7
26-50	5.7	6.9	4.2	28.6	3.3	1.8	15.4
51-75	4.7	6.9	2.1	0	6.7	5.5	0
76-99	10.4	12.1	8.3	14.3	13.3	9.1	7.7
100	12.3	12.1	12.5	0	20.0	10.9	7.7
Mean	30.2	34.6	24.8	13.9	40.3	26.1	24.8
No. of Respondents	106	58	48	7	30	55	13
Percent of Next Year Acquisitions Having Such Capability							
0	31.0	17.0	48.6	16.7	38.5	30.0	25.0
1-10	19.0	21.3	16.2	16.7	11.5	25.0	16.7
11-15	1.2	0	2.7	16.7	0	0	0
16-25	3.6	4.3	2.7	16.7	0	5.0	0
26-50	7.1	10.6	2.7	16.7	11.5	2.5	8.3
51-75	7.1	12.8	0	0	7.7	2.5	25.0
76-99	15.5	17.0	13.5	16.7	11.5	17.5	16.7
100	15.5	17.0	13.5	0	19.2	17.5	8.3
Mean	38.7	46.9	28.4	29.2	40.8	37.4	43.4
No. of Respondents	84	47	37	6	26	40	12
Percent of Next 2-5 Year Acquisitions Having Such Capability							
0	23.1	14.0	34.3	16.7	17.4	27.0	25.0
1-10	14.1	14.0	14.3	0	8.7	21.6	8.3
11-15	0	0	0	0	0	0	0
16-25	10.3	9.3	11.4	16.7	13.0	8.1	8.3
26-50	7.7	4.7	11.4	33.3	4.3	5.4	8.3
51-75	3.8	7.0	0	16.7	8.7	0	0
76-99	20.5	30.2	8.6	16.7	17.4	18.9	33.3
100	20.5	20.9	20.0	0	30.4	18.9	16.7
Mean	47.4	56.4	36.2	47.5	56.7	40.7	50.4
No. of Respondents	78	43	35	6	23	37	12
Percent of Next 6 or More Year Acquisitions Having Such Capability							
0	21.1	11.6	33.3	0	18.2	24.3	27.3
1-10	10.5	9.3	12.1	0	4.5	16.2	9.1
11-15	1.3	0	3.0	0	4.5	0	0
16-25	2.6	4.7	0	33.3	0	0	0
26-50	11.8	11.6	12.1	0	13.6	10.8	18.2
51-75	5.3	7.0	3.0	16.7	4.5	5.4	0
76-99	6.6	9.3	3.0	16.7	0	8.1	9.1
100	40.8	46.5	33.3	33.3	54.5	35.1	36.4
Mean	56.6	65.8	44.7	69.2	63.9	50.9	54.5
No. of Respondents	76	43	33	6	22	37	11

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 8. LEGAL INHIBITIONS TO METRICATION (PERCENT)

Legal Inhibitors	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
U. S. Federal/State Procurement Regulations	8.7	11.4	5.4	14.3	9.1	6.0	17.6
Building Codes	15.9	20.2	10.7	28.6	6.1	16.4	29.4
State/Local Laws	18.3	24.3	10.7	14.3	12.1	23.9	11.8
U. S. Federal Antitrust Laws	4.8	8.6	0	0	0	9.0	0
Other U. S. Federal Laws or Regulations	11.1	18.6	1.8	0	12.1	11.9	11.8
None	52.4	44.3	62.5	57.1	60.6	47.8	52.9
Don't Know	15.9	15.7	16.1	14.3	12.1	17.9	11.8
Number of Respondents	130	71	59	7	36	68	17

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

NOTE: Percentage do not sum to 100 because of multiple responses.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 9. NONLEGAL FACTORS INHIBITING METRICATION (PERCENT)

Factors	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Industry wide standards	29.2	35.2	22.0	42.8	25.0	30.9	29.4
Supplier	24.6	29.6	18.6	28.6	19.4	25.0	29.4
Customer demand	50.8	57.7	42.4	57.1	33.3	57.4	64.7
Non Mandatory status	8.5	9.9	6.8	14.3	2.8	7.4	23.5
Cost elements	23.1	25.4	20.3	28.6	16.7	23.5	35.3
Internal conflicts	28.5	26.8	30.5	57.1	27.8	29.4	17.6
Other	7.7	7.0	8.5	0	5.6	10.3	5.9
None	5.4	2.8	8.5	0	8.3	4.4	0
Don't know/No answer	7.7	4.2	11.9	0	5.6	8.8	11.8
Number of Respondents	130	71	59	7	36	68	17

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 10. REASONS FOR METRICATION (PERCENT)

Reasons	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Industry standard	17.9	17.8	18.2	20.0	33.3	11.7	10.0
Supplier	11.9	8.9	18.2	20.0	0	17.6	10.0
Customer demand	35.8	31.1	45.5	40.0	22.2	32.4	70.0
Government regulation	13.4	17.8	4.5	0	33.3	5.9	10.0
International standards	40.3	44.4	31.8	60	27.8	47.1	30.0
Reduction of inventory	6.0	6.7	4.5	0	5.6	5.9	10.0
Easier	9.0	8.9	9.1	0	0	11.7	20.0
Other	20.9	22.2	18.2	20.0	16.7	29.4	0
Respondents[b]	67	45	22	5	18	34	10
Don't know/not applicable	48.5	36.6	62.7	28.6	50.0	50.0	41.2
Total respondents	130	71	59	7	36	68	17

[a] "Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Date are included in totals.

[b] Companies who have begun to metricate.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 11. BENEFITS DERIVED FROM METRICATION (PERCENT)

Benefits	Total[a]	Top 500	2nd 500	Transportation	Cusumer Products	Manufacturing & Production	Aerospace & Electronics
Customers (Market Coverage)	26.6	23.1	33.3	25.0	18.8	29.0	33.3
Reduction of inventory	11.7	17.9	0	0	31.3	3.2	11.1
Easier	5.0	5.1	4.8	0	6.3	3.2	11.1
Other	13.3	15.4	9.5	25.0	6.3	16.1	11.1
None	50.0	48.7	52.3	50.0	50.0	51.6	44.4
Respondents[b]	60	39	21	4	16	31	9
Dont't know/Not applicable	53.8	45.1	64.4	42.9	55.6	54.4	47.1
Total respondents	130	71	59	7	36	68	17

[a]"Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

[b]Companies who have begun to metricate.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

TABLE 12. SUGGESTIONS FOR METRICATION (PERCENT)

Suggestions	Total[a]	Top 500	2nd 500	Transportation	Consumer Products	Manufacturing & Production	Aerospace & Electronics
Time	9.3	11.4	5.3	0	13.3	7.7	11.1
Planning	18.5	22.9	10.5	50.0	13.3	4.4	33.3
Encourage Industry	5.6	5.7	5.3	0	6.7	1.5	11.1
Other	11.1	17.1	0	0	13.3	7.7	22.2
None	64.8	57.1	78.9	50.0	60.0	73.1	55.5
Respondents[b]	54	35	19	4	15	26	9
Dont't know/Not applicable	58.5	50.7	67.8	42.9	58.3	61.8	47.1
Total respondents	130	71	59	7	36	68	17

[a] "Entertainment" category not broken out due to low response (two companies); data cannot be specified for reasons of confidentiality. Data are included in totals.

[b] Companies who have begun to metricate.

SOURCE: King Research, Inc., U. S. Metric Board Survey of Selected Large U. S. Firms and Industries, 1980.

APPENDIX D

DISCUSSION OF NON-RESPONDENTS

DISCUSSION OF NON-RESPONDENTS

1. Introduction

Seventy-two companies did not return questionnaires. Therefore, the question arose concerning the representativeness of the sample returns. We compared respondents with non-respondents in terms of (1) percent involved in metrication, and (2) median annual sales volume.

2. Respondents Involved in Metrication

A company was considered to have metric sales if it responded to question number 4 by supplying a non-zero number describing the *percentage of its U.S. or non-U.S. net sales in 1978 which* involved metric products.

Table 1 displays the sample (mail-out) sizes for the Top 500 and second 500 companies, 101 each. Overall, 64 percent (130) of the 202 questionnaires were returned as useable.

TABLE 1. RESPONSE TO SURVEY

Category	Number Mailed	Returns No.	Returns %
Top 500	101	71	70
2nd 500	101	59	58
Total	202	130	64

SOURCE: King Research, Inc.

Table 2 divides the survey returns into those companies with metric sales, and those without metric sales. Of those companies which responded to question 4 by giving both or either percents for U.S. and foreign sales (86 percent or 112 of the 130 returns), 62 percent reported having metric sales. This breaks down to 77 percent of the 62 Top 500 respondents and 44 percent of the 50 second 500 respondents. We do not know if the 18 of the 130 returns which did not answer question 4 had 1978 metric sales or not.

TABLE 2
RESPONDING COMPANIES HAVING
METRIC SALES IN 1978

Category	Companies with metric sales					Companies Without Metric Sales		Total	
	U.S. Only	Non-U.S. Only	Both	Sub-total					
	no.	no.	no.	no.	%	no.	%	no.	%
Top 500	1	9	38	48	77	14	23	62[a]	100
2nd 500	5	6	11	22	44	28	56	50[a]	100
Total	6	15	49	70	62	42	38	112[b]	100

SOURCE: King Research Inc.

a. Does not include 9 companies which did not answer question 4.

b. Does not include 18 companies which did not answer question 4.

3. Comparison of Respondents with Non-Respondents

Two telephone followups were conducted to increase survey response rates. The first follow-up simply requested return of the questionnaires. The second folow-up was an all-out effort to obtain completed questionnaires by conducting complete telephone interviews with non-respondents. For continued refusals, we attempted to determine if the non-respondent was involved in any metrication activities.

Table 3 tallies the non-respondents (i.e., those companies for whom we did not obtain a completed questionnaire by mail or telephone) by whether or not they were currently involved in metrication activities.

TABLE 3
NON-RESPONDENTS
HAVING METRICATION ACTIVITIES

Category	Have Metrication		Don't Have Metrication		Data Not Available		Total Non-Respondents	
	no.	%	no.	%	no.	%	no.	%
Top 500	8	27	3	10	19	63	30	100
2nd 500	6	14	9	21	27	64	42	100
Total	14	19	12	17	46	64	72	100

SOURCE: King Research Inc.

As the total shows, 64 percent of the 72 non-respondents were not willing to answer any questions concerning their metrication status. Reasons given for unwillingness to supply this informtion were the following:

- Too many subsidiaries
- Information not readily available
- Not qualified since they were holding companies
- Confidentiality
- No time available to answer questions

Of the 26 non-responding companies which were willing to supply the information, 14 (54%) were involved in some sort of metrication activity. If the assumption is made that the 46 refusals are distributed the same as the 26 companies which were willing to supply the information, and the assumption is made that the 18 respondents who did not answer question 4 (see Table 2) are similar to those who answered question 4, then it appears that, taking into account the somewhat broader definition of metrication used in the interviews, that metrication among respondents (63%) is only slightly higher than among the non-respondents.

Tables 4 and 5 display the median and mean annual sales volume of respondents and non-respondents. In addition, Table 4 displays the medians for both the Top 500 and the second 500, as well as for the mail-out sample. We conclude from these tables that (a) the mail-out sample was representative of the population, and (b) that non-respondents had slightly smaller annual sales than respondents.

TABLE 4
COMPARISON OF MEDIAN
ANNUAL SALES FOR 1978

Category	Total Population (Millions $)	Mail-out Sample (Millions $)	Respondents (Millions $)	Non-Respondents (Millions $)
Top 500	1,062.0	930.7	1,107.1	801.7
2nd 500	189.9	181.9	195.1	173.5
Total	379.5	380.2	434.4	287.3

SOURCE: Fortune Magazine, May 7, 1979 and June 18, 1979

TABLE 5
COMPARISON OF MEAN
ANNUAL SALES FOR 1978
FOR RESPONDENTS AND
NON-RESPONDENTS

Category	Respondents (Millions $)	Non-Respondents (Millions $)
Top 500	2043.3	1166.8
2nd 500	214.	191.9
Total	1230.5	590.1

SOURCE: Fortune Magazine, May 7, 1979 and June 18, 1979

APPENDIX E

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